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SHIPBOARD TRAINING AND MAINTENANCE FOR MERCHANT VESSEL SURVIVAL--ETC(U)

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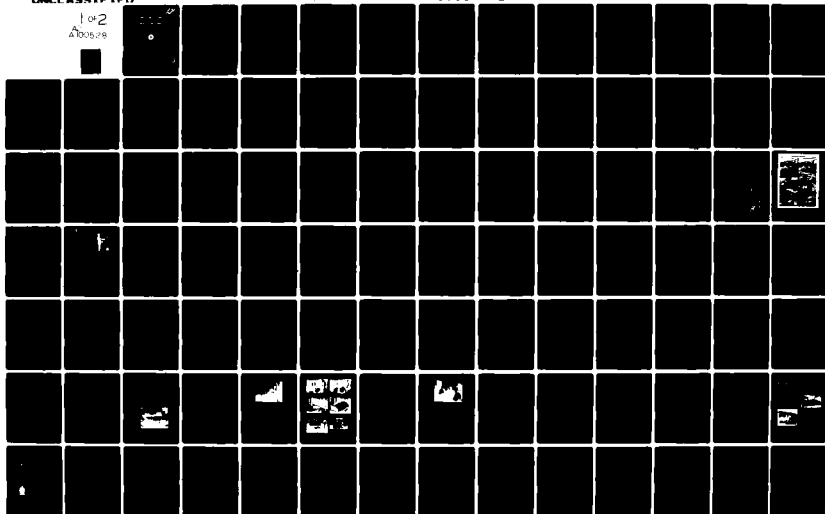
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**SHIPBOARD TRAINING AND MAINTENANCE  
FOR  
MERCHANT VESSEL SURVIVAL EQUIPMENT**

AD A100528

**THE STANWICK CORPORATION  
1401 Wilson Boulevard  
Arlington, Virginia 22209**



**OCTOBER 1979**

**FINAL REPORT**

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Prepared for

**U.S. DEPARTMENT OF TRANSPORTATION  
United States Coast Guard  
Office of Research and Development  
Washington, D. C. 20590**

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16. Abstract A study was performed to develop recommended approaches for the Coast Guard to take in establishing requirements for merchant vessel survival (lifesaving and firefighting) equipment routine maintenance information and the continuing training and drills of the vessel's crew in the use of that equipment. A background study included review of marine casualties, interviews of 48 industry and government maritime officials and visits to nine ships and drill rigs. Study indicated inadequate knowledge of survival procedures, lack of leadership and correct decision-making in emergencies, inadequate assignment of duties and responsibilities, unreadable or unclear posted operating instructions, lack of maintenance information or programs, inadequate maintenance, unrealistic and unproductive drills, lack of liferaft training, shortage of good training materials particularly films, and a need for more shore firefighting training. Efforts to train on board ship are frustrated by rapid crew turnover and lack of motivation. Principal recommendations are to institute uniform, comprehensive requirements for posted operating instructions; require documented maintenance programs; revise requirements for drills to make them more realistic; develop a "Shipboard Survival Training Guide;" enforce more stringent inspections of drills; produce survival training films; require pre-sea and periodic refresher survival training; and develop emergency situation leadership and decision-making courses.			
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## SECTION 1

### INTRODUCTION AND SUMMARY

#### 1-1 BACKGROUND

Effective response to a shipboard emergency situation, whether fire, flooding, man overboard, or the necessity to abandon ship requires that the appropriate survival equipment be available in good operating condition and that it be correctly operated. Effective response also requires that the crew be thoroughly familiar with emergency procedures, trained to work together as a team, and be effectively organized and led.

Investigations of shipboard fires, collisions, flooding and ship abandonments have repeatedly found lack of knowledge and training in the operation of survival equipment and in survival procedures and inadequately maintained survival equipment as principal or contributing causes to loss of ships and loss of life. Coast Guard inspections continue to reveal inoperative or badly corroded survival equipment and crewmen who are confused as to their emergency stations or duties.

The great diversity in types of ships, their greatly increased size, the high tempo of operations and the rapid turnover of their crews have combined to have an adverse impact on the ability to effectively train the crew in survival procedures. Upon sailing, more than half the crew may be totally unfamiliar with the ship, with its survival equipment, and with each other. High speeds, tight schedules, and rapid port turnarounds mean that time for survival training, particularly that which would delay the ship such as putting boats or liferafts in the water, is very hard to find.

On board drill rigs captained by toolpushers and manned by roustabouts, survival training is complicated by the absence of a well-defined chain of



command and the presence of a large and constantly changing population of non-seagoing personnel.

New and sometimes more complex survival equipment such as enclosed lifeboats, survival capsules, exposure suits, EPIRB's, and halon fire extinguishing equipment have appeared on the scene and further innovations in survival equipment are bound to follow. The effectiveness of this new equipment will be lost unless it is accompanied by comparable improvements in training and maintenance.

New international agreements pending ratification contain a number of new concepts in survival training and survival equipment maintenance which will require changes in U.S. regulations if they are adopted. Examples are pre-seagoing survival training for all seamen, shore firefighting training for nearly all licensed and certificated personnel, more definitive requirements for Certificates of Proficiency in Survival Craft, survival training manuals for the crew, specific requirements for periodic maintenance and inspection of survival equipment, and requirements for maintenance manuals for survival equipment.

The foregoing factors dictate a need to examine the current state of shipboard survival training and survival equipment maintenance in order to define problems and deficiencies clearly and determine the most effective means to correct them either through revision of regulatory requirements or other measures.

#### 1-2 OBJECTIVE

The objective of the study was to develop recommended approaches for the Coast Guard to take in establishing requirements for merchant vessel survival

equipment routine maintenance information and the continuing training and drills of the vessel's crew in the use of that equipment. The following equipment was to be considered:

- Personal flotation devices
- Exposure suits
- Lifeboats and survival capsules
- Liferafts
- Launching equipment for survival craft
- Survival craft equipment
- Fire detection and alarm systems
- Firefighting apparatus and fire extinguishing systems
- Breathing apparatus
- Line throwing appliances
- Rescue boats
- Emergency loudspeaker systems
- Emergency radio equipment (EPIRBs and lifeboat radios)

Vessels to be considered in the study were all U.S. flag inspected vessels including artificial islands and mobile offshore drilling units.

The primary emphasis was to be on shipboard training and any shore training provided by the operator rather than on pre-sea training such as received in courses leading to a lifeboatman's certificate. Recommendations were to cover the type and extent of on-board training that should be required; the manner in which such training should be presented; the need for new requirements for maintenance information; and ways to make carrying out of maintenance requirements easier, short of equipment modifications. In addition to maintenance information, investigations included examination of operating information such as posted equipment operating instructions and posted instructions on survival procedures, e.g., how to enter water from a height.

### 1-3 METHODOLOGY

As the first step, a background study was conducted to obtain information on the nature and extent of problems and deficiencies in survival training and survival equipment maintenance and operating information. Another objective of the background study was to identify the applicable U.S. regulatory requirements for survival training and survival equipment maintenance and operating information as well as proposed IMCO/SOLAS requirements. The background study was comprised of the following tasks:

- Research of marine casualty reports and other reports, studies, articles, etc., concerning any and all aspects of survival equipment operation and maintenance and survival training. A list of literature sources appears in the bibliography in Appendix B.
- Research of the Code of Federal Regulations and IMCO and SOLAS conventions to identify all U.S. regulatory requirements and proposed IMCO and SOLAS requirements related to survival training and equipment. A list of the regulatory sources is included in the bibliography in Appendix B.
- A survey of manufacturers of survival equipment to obtain information on their maintenance manuals and the kinds of training offered. A list of the manufacturers who provided information is contained in Appendix C.
- Interviews of government and industry personnel concerned with operation, safety, training, and inspection of merchant ships and drilling rigs. A list of interviews and visits is contained in Appendix C.
- Visits to ships and drill rigs to interview officers and crewmen, to examine survival equipment, and to witness fire and boat drills. A list of ships and drilling units visited is contained in Appendix C.

The information obtained from the literature survey, interviews, and visits was organized into three major areas for study as follows:

1. Operating Instructions and Information
2. Maintenance Information and Performance
3. Training

In each area, the applicable regulatory requirements, the proposed IMCO/SOLAS requirements, and the observed or reported deficiencies were identified and documented.

An analysis was then conducted using critical examination techniques as follows. First, the deficiencies in each area were compared with existing U.S. regulatory requirements to identify the need for changes or additional requirements or other measures to satisfy the need. IMCO and SOLAS requirements were included in the comparison. Second, recommendations from all sources which would satisfy the needs in each area were listed. Sources included recommendations from marine boards of investigation, recommendations received in interviews, and recommendations developed by study group personnel. Assumptions and criteria for use in judging economic, practical, and regulatory feasibility of the recommendations were developed. Finally, the most feasible recommended approaches were selected and documented.

#### 1-4 RESULTS OF BACKGROUND STUDY

The literature survey, particularly the review of marine casualty reports, provided realistic definitions of specific problems in survival training and survival equipment maintenance on the basis of the actual performance of men and equipment in survival situations. Seventeen marine casualty reports were reviewed of which twelve were ships and five were drill rigs. Included in the casualties were six fires or explosions, eight sinkings and thirteen ship or rig

abandonments. The review indicated problems in the following areas: Exercise of command responsibility, leadership, and assignment of responsibility; shipboard training and drills; lifeboat launching and handling; use of inflatable liferafts; understanding of meaning of alarms; wearing of personal flotation devices; operation of portable lifeboat radio transmitter; helicopter rescue; firefighting; equipment operating instructions; and equipment maintenance.

In the interview phase, a total of 48 individuals representing shipping companies, unions, training and educational institutions, government agencies, and private firms were interviewed. Included in the sample were 12 shipping firms, two drilling companies, three unions, five maritime training institutions, three Coast Guard Marine Inspection offices and representatives of the Maritime Administration, the Maritime Training Advisory Board, the National Safety Council, and the American Bureau of Shipping as well as several private training and consulting firms. Questions were asked concerning current problems and deficiencies in survival training and equipment, and recommendations for solutions were solicited. Nearly all interviewees pointed to rapid crew turnover as the major problem frustrating efforts to provide effective on-board training. The repetitive and unrealistic nature of fire and boat drills plus an almost total lack of liferaft training were cited as the major deficiencies in shipboard training. Other deficiencies frequently reported were lack of good training materials, particularly films, lack of motivation to perform training, and the poor abilities of officers as instructors. Shipping company officials, school instructors, and Coast Guard officers all expressed particular concern over the ability of officers, particularly masters, to make correct decisions and exercise effective leadership in emergency situations. School instructors

also pointed out the need to rewrite training materials to match the average reading level of merchant seamen. Recommendations which were offered by a significant number of individuals included: 1) Use simulation in drills; 2) Have surprise drills and night drills; 3) Require firefighting training for all shipboard personnel; 4) Provide pre-sea survival training and refresher training periodically thereafter; 5) Provide emergency situation decision-making and leadership training for officers; 6) Supplement drills with training films. Many other recommendations for improving both shipboard and shore survival training were offered and all of these were considered and evaluated in the analysis.

Letters of inquiry to thirty manufacturers of survival equipment yielded eighteen replies and provided examples of maintenance manuals and information on training offered. Review of the maintenance manuals showed that they vary widely in quality and sometimes fail to provide adequate maintenance information.

Visits were made to five cargo ships, one drill ship, and three mobile drilling units. Licensed and unlicensed personnel were interviewed informally; fire and boat drills were observed; and station bills, operating instructions, maintenance records, and survival equipment were examined. Interviews and observations of drills confirmed the deficiencies in training reported in prior interviews of industry and training personnel. Questions on survival procedures indicated inadequate knowledge particularly in the areas of liferaft operation, and personal survival techniques, e.g., understanding of hypothermia. Operating instructions were not available for some equipment or were difficult to read or understand and, in two instances, incorrect. Information on routine maintenance was generally lacking and maintenance programs or records were only found on two ships. Examination of survival equipment revealed lack of maintenance particularly with respect to corrosion control and lubrication of lifeboat davits.

## 1-5 SUMMARY OF MAJOR CONCLUSIONS

The following are the major conclusions reached concerning survival knowledge, performance and training; survival equipment operating information, maintenance information and maintenance performance; and related regulatory requirements.

### a. Survival Knowledge and Performance

Marine casualty reports and interviews of shipboard personnel indicate inadequate knowledge of survival equipment operation and survival procedures; inability to make correct decisions and provide leadership in emergencies, inadequate assignment of responsibilities and duties, failure to comply fully with regulatory requirements for drills, inadequate or unavailable operating instructions, and failure to perform required maintenance.

### b. Operating Instructions and Information

- Based on the limited sample observed, posted operating instructions are: 1) unavailable for certain equipment, 2) not always appropriately located, 3) sometimes difficult to read, 4) for certain equipment, wordy, difficult to understand, and even incorrect.
- Current guidelines (i.e., published specifications and regulations) governing promulgation of operating instructions and information applicable to survival equipment and personnel survival procedures are not consistent. As a result, posted procedures based on these guidelines are not always easily readable or readily understandable.

### c. Maintenance Information and Performance

- The lack of any specifications or standards for survival equipment maintenance manuals contributes to such deficiencies as poorly defined maintenance requirements, illegible drawings, and lack of a schedule of periodic maintenance requirements.

- Based on the limited sample observed, few ships have a documented maintenance program for survival equipment, or have adequate information on survival equipment maintenance requirements, or keep records of maintenance performed. This situation undoubtedly contributes to the poor material and operating conditions observed.

d. Training

- The high rate of crew turnover in most ships frustrates and complicates efforts to attain an adequate level of survival training particularly with respect to developing teamwork. It also greatly reduces or eliminates operators' willingness to expend time or money in providing any additional survival training or training aids beyond that required by regulations.
- Survival training on drill rigs is complicated by the lack of a well-defined chain of command for emergencies and the large number of non-seagoing, transient personnel.
- Typical station bills do not provide adequate organization or assignments for effective action in emergencies.
- Current Coast Guard regulations and inspection procedures are not effective in obtaining an adequate level of shipboard survival training through drills. Typically, drills are performed by rote with minimal compliance with regulatory requirements. Emergency equipment is not used or demonstrated, and emergency situations are not simulated.
- The standard procedure of fire drill followed by boat drill tends to breed a conditioned response to shipboard emergencies to abandon ship rather than cope with the emergency and to always abandon via lifeboats.
- The absence of any regulatory requirement for liferaft training is reflected by an almost total lack of such training aboard ships.
- A lack of well-prepared, up-to-date, effective survival training materials such as posters, pamphlets, manuals, and films suitable for shipboard use contributes to the low level of knowledge of survival equipment procedures and operation and personal survival techniques.



- The usefulness of existing survival materials is limited by the fact that they are not written to the average seaman's reading level or designed to capture his interest.
- Firefighting training with actual fires at shore schools is the most effective method of instilling firefighting skill and confidence. If all crewmen received this training, emergency team training aboard ship could be far more effective.
- Marine boards of investigation have found lack of organization, leadership, and ability to correctly evaluate information and make appropriate decisions in emergencies to be principal causal factors in a number of marine casualties. In the opinion of many industry interviewees, these shortcomings are common, and indicate an urgent need for emergency situation leadership and decision-making training for merchant marine officers, particularly masters.

#### 1-6 SUMMARY OF MAJOR RECOMMENDATIONS

The following are the major recommended approaches offered to improve shipboard survival training and survival equipment operating instructions, maintenance information and maintenance performance.

As is evident from the survey of on-board training, regulations by themselves are not effective in achieving a satisfactory state of survival training or survival equipment readiness. As a result, in developing recommendations, other measures which the Coast Guard could take or could encourage other government and industry organizations to take were also considered and are included in the recommended approaches that follow.

##### a. Operating Instructions and Information

- Review and revise specifications and regulations for all types of survival equipment and survival procedures to establish uniform, definitive requirements and standards for posted (or attached) operating instructions and information which will ensure appropriately located, easily readable, and readily understandable instructions.

- Request the Maritime Administration or other appropriate agency to develop and provide posters on such survival procedures as water entry from a height, hypothermia, helicopter rescue, and lifeboat/liferaft survival techniques.

b. Maintenance Information and Performance

- Require ships to have an approved, documented maintenance program for survival equipment which would include a schedule of the maintenance requirements (regulatory and manufacturer) for each equipment and a record of their accomplishment. A precedent for such a requirement is the requirement in NVIC 1-69 for an approved maintenance program for unattended engineering plants.

c. Training

- Require that every prospective seafarer be given survival training as prescribed in Resolution 19 of the IMCO Convention on Standards of Training, Certification, and Watchkeeping before going to sea.
- Develop a "Shipboard Survival Training Guide" which would provide a recommended program of drills, exercises, demonstrations, etc.; suggested assignments of training responsibilities; and scenarios for drills.
- Revise station bill requirements in 46 CFR 97.13 to require more adequate organization and assignment of personnel to meet all types of emergencies including man overboard and rescue of survivors.
- Require only one type of drill per week instead of both fire and abandon ship drills. Specify a required frequency for each type of drill, e.g., two fire drills, one abandon ship, and one other type of drill per month.
- Require one drill per quarter to be held at night.
- Require every other abandon ship drill to be a liferaft drill.
- Authorize viewing of audio-visual training aids as a partial substitute for drills (showing of film must be followed by demonstration or use of equipment to qualify as a drill).

- Establish and enforce more stringent standards and requirements for Coast Guard inspections of drills including a requirement to simulate emergencies.
- Consider establishing mandatory requirements for crew survival training manuals as set forth in the SOLAS proposed regulation D VII/1 and for survival indoctrination pamphlets for new crewmembers.
- Request the Maritime Administration or Maritime Advisory Training Board to establish standards for survival training materials.
- Encourage acceleration of the Maritime Administration and Maritime Advisory Training Board program to develop training films on survival procedures and shipboard firefighting.
- Foster and encourage programs to increase awareness of survival hazards and to make maximum use of company safety programs, equipment-manufacturer training, safety bulletins, and training films through the public awareness program and articles in the Proceedings.
- Consider publishing a companion periodical to the Proceedings, aimed at the unlicensed personnel level.
- Require shore firefighting training for all licensed and certificated personnel. Require refresher firefighting training every five years.
- Request the Maritime Administration develop a "Survival Operations Manual" for distribution to all merchant ships. This manual would contain guidance for emergency situation decision making and emergency squad and lifeboat/liferaft leadership.
- Propose that maritime academies develop special short courses for prospective masters which would include training in emergency situation decision making. Such courses might be made mandatory prior to assuming command.

## SECTION 2

### PROBLEM DEFINITION

#### 2-1 INTRODUCTION

As part of the background study, marine casualty reports and other literature sources were researched to determine the nature and extent of survival training and equipment maintenance problems as revealed by personnel and equipment performance in actual survival situations. In addition, during ship visits, crewmen were interviewed to determine their knowledge of survival equipment operation and survival techniques. This section describes the results of this part of the investigation.

#### 2-2 PERSONNEL PERFORMANCE IN SURVIVAL SITUATIONS

The following paragraphs present pertinent findings and conclusions extracted from marine casualty reports relevant to the performance of personnel in survival situations. Marine casualty reports are identified by the name of the ship or rig involved.

a. Exercise of Command Responsibility, Leadership, and Assignment of Responsibility

SHELL PLATFORM A, BLOCK 33, August 1972. Survival capsule dropped 35 feet into water as a result of failure to properly lock Rottmer hook.

- A contributing cause was the absence of a designated trained person to be in charge of the capsule. The platform station bill did not provide for any person to be in charge of capsule, nor did it assign any specific duties aboard the capsule.

SS SMITH VOYAGER, December 1964. Ship abandoned and sank. Four lives lost during transfer from lifeboat to rescue vessel.

- The primary cause of the loss of the ship was premature abandonment of the engineering plant and the vessel. The premature abandonment with the tacit approval of the Master indicates evidence of the failure of the Master to exercise command responsibility.
- No orders or preparations had been issued to the persons in the lifeboat and no advance preparations had been made in the lifeboat for transfer of personnel to the rescue ship. As some of the men attempted to climb up the side of the rescue ship, they were crushed between the side of the ship and the surging lifeboat. Four men lost their lives in this manner.
- Lack of leadership prevented a reasonable attempt to manage the lifeboat.

SS PANOCEANIC FAITH, October 1967. Vessel sank as a result of progressive flooding of forward holds in heavy weather. Crew unable to launch lifeboat. Liferaft drifted away after launching. Thirty-six crewmembers out of 41 were lost.

- The loss of life resulted from a number of causal factors including the failure of the Master to recognize the critical condition of his vessel, and request assistance earlier.

MV MARYLAND, December 1971. Tug with tow sank in heavy weather as a result of progressive flooding and failure to cut tow loose. Six of seven crewmembers were lost.

- Throughout the efforts to save the tow, the master did not advise the crew to prepare to abandon ship. By the time the crew became aware of the need for PFD's, the flooding and vessel heel probably prevented their return to the crew berthing compartment, where six of the PFD's were stowed.

b. Drills, Training

OCEAN EXPRESS (Drill Rig), April 1976. Crew abandoned rig in two survival capsules. One capsule capsized due to wave action and shifting weight. Seven men escaped, thirteen were trapped inside and drowned.

- Training and drills pertaining to abandonment and use of lifesaving appliances and equipment were inadequate. As a result, crew was unfamiliar with operation of lifesaving equipment, emergency procedures, and lacked knowledge as to availability of certain equipment within capsule.
- The owner who had primary responsibility for training of the crew and safety of other persons, such as subcontractors and visitors, did not provide a sufficient level of training or indoctrination.

MV VENUS, May 1972. Gasoline vapors, generated while washing cargo tanks, entered forward deckhouse and exploded. Master of the VENUS was killed by the explosion.

- Vessel had failed to conduct fire and boat drills as required during the three weeks prior to the casualty; however, there was no significant indication that the failure had an effect on the crew's efforts to fight the fire following the explosion.
- There was no positive policy for training or indoctrinating the constantly changing personnel on board the VENUS. Written instructions and safety procedures were nonexistent. Verbal instructions were the only means of passing vessel policy to new men, and there is nothing in the record to indicate this was done in a systematic manner.

SS EDMUND FITZGERALD, November 1975. Ore carrier sank in severe storm, probably as a result of massive flooding of cargo hold.

- Lifeboat drills were held but not on a regular basis. However, it can not be concluded that lack of lifeboat drills directly contributed to loss of life.

SS PANOCENIC FAITH (previously cited)

- The failure to hold a fire and boat drill within 24 hours of leaving port as required by 46 CFR 97.15-35, and the failure to operate lifeboat engines at least once a week as required by 46 CFR 97.15-45(b), constitutes evidence of negligence on the part of the Master.

CONTINENTAL OIL RIG 43-A, October 1967. Explosion and fire. Crew abandoned tower. All safely rescued.

- Emergency drills were not held or scheduled aboard 43-A platform. Transient personnel were not instructed concerning any specific emergency procedures, or the locations of lifesaving equipment.

KERR-McGHEE (Offshore Drill Platform), October 1973. Blowout and fire. All hands abandoned safely in survival capsule.

- The evacuation drill held the day before the casualty was instrumental in the prompt and orderly evacuation of the rig when the fire started.

c. Lifeboat Launching and Handling

C.V. SEA WITCH, June 1973. Collided with anchored tankship ESSO BRUSSELS. Both ships set on fire. Sixteen lives lost.

- The extensive loss of life of the crew on the ESSO BRUSSELS may not have occurred or may have been greatly reduced had there been no delay in releasing the lifeboat falls and had the hand-cranked lifeboat engine immediately started.

SS SILVERDOVE, April 1973. Cargo shifted developing severe list. Crew abandoned in two lifeboats. All hands rescued.

- In boat No. 2 the men had difficulty coordinating the flemming gear, either due to lack of experience or seasickness.

SS TRANSHURON, September 1974. Fire in main propulsion control switchboard caused loss of main propulsion. Ship drifted aground. Crew abandoned by lifeboat.

- Difficulty encountered during launch of No. 3 lifeboat was caused by failure of the crew to use proper procedures and operate the release lever for simultaneous release of the falls at both ends of the boat.

MV MARYLAND (previously cited)

- The lack of training in abandon-ship procedures and use of lifesaving equipment resulted in disorderly lifeboat launching efforts and failure to fully utilize all available lifesaving equipment.

d. Use of Inflatable Liferafts

SS SMITH VOYAGER (previously cited)

- The loss of life of the four crewmembers might have been prevented if inflatable liferafts had been available and used for abandoning ship.

SS EDMUND FITZGERALD (previously cited)

- Opinions expressed by Great Lakes mariners testifying at investigation were that successful launching of lifeboats in prevailing conditions is unlikely and that Great Lakes mariners



would choose inflatable liferafts but do not believe they could be boarded safely once launched, therefore would inflate on deck and wait to float free.

- Opinions of the Marine Board are that the level of understanding of the use and capability of inflatable liferafts is inadequate. There were no survivors in this case and any conclusions about proper training are based on opinion.

SS PANOCENIC FAITH (previously cited)

- More lives would probably have been saved if, when difficulty was experienced in launching the boat, the 25-person inflatable liferaft had been launched and boarded before the ship sank.
- The failure of the crew to launch the inflatable liferaft prior to sinking of the ship suggests that merchant seamen need additional training concerning abandon-ship procedures.

e. Understanding of Meaning of Alarms

SS SMITH VOYAGER (previously cited)

- The one long ring of the general alarm bell evidently set in motion a chain of events which led to the engineering plant being prematurely secured and the vessel abandoned.

f. Use of Personal Floatation Devices

MV COMET, May 1973. Small passenger-carrying fishing vessel sank as a result of flooding through deteriorated hull planking. Only 11 of 27 persons on board were saved.

- The Coast Guard-approved adult life preservers did not keep some passengers' faces out of the water due to either lack of training or knowledge by individuals in how to properly wear a life preserver or by fault of design.

g. Operation of Portable Lifeboat Radio Transmitter

SS TEXACO OKLAHOMA, March 1971. Tankship broke in two in heavy weather. 31 lives lost.

- Portable lifeboat radio transmitter was probably incorrectly rigged or improperly tuned. Distress message was never received.

h. Helicopter Rescue

MV CHESTER A. POLING, January 1977. Coastal tankship broke in two in heavy weather. Six of the seven-man crew were rescued by the combined efforts of a Coast Guard cutter and Coast Guard helicopter.

- Contributing to the loss of life were the lost seamen's failure to wear a personal floatation device, and improper handling of the Coast Guard helicopter's rescue basket by the POLING's crew, which resulted from the crew's lack of training and their inability to hear Coast Guard instructions over the noise created by the helicopter, high winds, and breaking seas.

i. Firefighting

C.V. SEAWITCH (previously cited)

- The lack of crew training in proper firefighting techniques is evident by the manner in which the hoses and fire stations were left open thereby depriving the crew of firefighting capability prior to rescue.

SS TEXACO NORTH DAKOTA, October 1973. Explosion in pumproom killed three men in engineroom.

- Second mate unsuccessfully attempted to release CO<sub>2</sub> into the pumproom to prevent reflash because he failed to operate system correctly although adequate instructions were posted.

SS TRANSHURON (previously cited)

- Attempts to activate CO<sub>2</sub> firefighting system were unsuccessful. The Board could not determine if the system had been operated properly.

## 2-3 SURVIVAL EQUIPMENT OPERATING INFORMATION

Research of marine casualty reports also yielded the following conclusions relevant to the adequacy of survival equipment operating information.

SHELL PLATFORM A (previously cited)

- The casualty could have been prevented if there had been instructions readily available to the capsule personnel from which the proper procedure for securing the capsule could have been ascertained.

OCEAN EXPRESS (previously cited)

- Difficulty in releasing the survival capsule from its lowering cable was attributable in part to the fact that the instructions on how to release the capsule were not sufficiently clear.

SS TEXACO OKLAHOMA (previously cited)

- Concerning the instructions for rigging and operating the portable lifeboat radio, the report stated that, without the expertise of the radio officer who was lost with the bow section and under the crisis conditions prevailing on the stern section, it was unlikely that the crewmembers could follow each and every instruction precisely. The report recommended that the operating instructions be rewritten so as to be easily understood and followed by a person unskilled in radio operation and completely unfamiliar with the equipment.

## 2-4 SURVIVAL EQUIPMENT MATERIAL CONDITION

The following examples of unsatisfactory material conditions in survival equipment were noted in casualty reports and articles.

SS PANOCEANIC FAITH (previously cited)

- Testimony of the survivors indicates that No. 2 lifeboat was swinging freely on the falls and that they were of the opinion that the lifeboat failed to lower further due to frozen sheaves.

Proceedings of the Marine Safety Council, July 1976, p. 121, "Davits. . . Again"

- A deteriorated pin which secured the davit arm to the deck sheared allowing the forward davit arm to collapse. Fortunately, no personnel were injured. Casualty records reflect many davit failures due to component weaknesses which were not readily apparent, such as worn davit arm pivot pins, wasted straps on fall blocks, and corroded foundation attachments.

Proceedings of the Marine Safety Council, May 1979, p. 86, "The Great Lakes Ship Riding Program"

- In connection with the Great Lakes ship riding program, three vessels were found to have dangerously malfunctioning lifeboat winches. A crewman reported a fire station that hadn't been operable for two years.

Proceedings of the Marine Safety Council, December 1978, page 137, "Lessons from Casualties"

- Recently, maintenance was being conducted on a lifeboat. After the falls were slushed, the boat was heaved back into position. The forward falls parted, transferring the weight of the boat to the after falls; they parted, and the boat was dropped into the sea. Both areas where the wire broke were constantly exposed to the weather and had shown signs of broken strands. Such warning signs should be heeded so that inspection scope is increased and necessary repairs or replacements are made.

"Maintenance of Lifesaving Equipment" by Commander Leonard E. Penso, U.S. C.G. Paper presented to Marine Section, National Safety Council, October 1956.

- Lifeboat air tank rusted through at corner. Leak covered with adhesive tape and painted to hide discovery. Lifeboat hand-propelling gear and releasing gear frozen as a result of lack of lubrication or excess paint. Three-sheave steel block carried away and dropped after end of boat. Examination of this and five other blocks revealed that internal parts had wasted away due to corrosion.

## 2-5 KNOWLEDGE OF SURVIVAL EQUIPMENT OPERATION AND TECHNIQUES

During ship and drill rig visits, licensed and unlicensed crewmen were interviewed informally to determine the extent of their knowledge and understanding of the use or operation of survival and firefighting equipment. The major areas in which those interviewed lacked knowledge, understanding or training were:

- Engineering and steward personnel did not think they would be able to launch a lifeboat by themselves in an emergency.

- Approximately one third did not have any knowledge of how to operate a breathing appliance. Few had had an opportunity to actually try one out.
- Approximately two thirds had never had shore firefighting school training.
- None had seen a liferaft inflated or launched and knowledge of liferaft operation was extremely limited. A licensed officer stated that he thought the best way to use a liferaft was to inflate it on deck, get in, and float off as the ship sank.
- Approximately one third had not received instruction in operation of the portable radio.
- One seaman with many years of seagoing experience thought the best way to jump into the water with a lifejacket on was to roll himself into a ball.
- Of two licensed and one unlicensed personnel questioned, none understood what hypothermia was or how to minimize its effects.

## 2-6 DEFINITION OF PROBLEM AREAS

The foregoing review of marine casualty reports and other literature sources and interviews of shipboard personnel clearly indicate the following major problems in survival knowledge, procedures, training, and equipment operating instructions and maintenance:

- Lack of effective organization and assignment of duties for emergencies aboard drill rigs.
- Inability at the command level to properly evaluate information in emergency situations and take appropriate action.
- Lack of leadership at both the ship and lifeboat command levels.

- Failure to conduct emergency drills and carry out shipboard survival training as required by regulations.
- Inadequate knowledge of the operation of survival equipment and survival procedures, such as launching and operation of lifeboats; use of liferafts; meaning of alarms; wearing of personal flotation devices; water entry from a height; operation of portable lifeboat radios; helicopter rescue procedures; firefighting techniques; operation of fixed CO<sub>2</sub> systems; and minimizing effects of hypothermia.
- Inadequate or unavailable operating instructions for survival equipment such as portable radios and survival capsules.
- Unsatisfactory operating or material conditions of survival equipment as a result of failure to carry out required inspections and maintenance.

## SECTION 3

### OPERATING INSTRUCTIONS AND INFORMATION

#### 3-1 INTRODUCTION

This section sets forth the regulatory requirements for operating instructions and information to be provided for survival equipment and survival procedures and describes the operating instructions and information that are actually provided aboard ships and rigs in terms of format, content, location, readability, understandability, reading level, etc. Apparent deficiencies in operating instructions and information are identified.

#### 3-2 REGULATORY REQUIREMENTS FOR OPERATING INSTRUCTIONS AND INFORMATION

##### a. Personal Flotation Devices

For passenger vessels only, printed notices informing passengers of the location of life preservers and describing and illustrating the method of donning and adjusting them must be posted in every passenger cabin and stateroom and in conspicuous places about the decks. 46 CFR 75.40-25, 78.47-47.

##### b. Exposure Suits

There are no requirements for information on donning or using exposure suits.

##### c. Lifeboats and Survival Capsules

There are no requirements for operating information for lifeboats or survival capsules.

##### d. Rescue Boat

There are no requirements for operating information for rescue boats.



e. Liferafts

(1) For vessels equipped with inflatable liferafts, approved placards containing instructions for launching and inflating liferafts must be posted in conspicuous places which are regularly accessible to the crew and/or passengers. 46 CFR 97.39-1.

(2) Each inflatable liferaft must be provided with the following operating instructions:

- On the exterior of the container, in two locations, instructions for manually launching and inflating; directions for righting if the raft inflates in an inverted position; directions for boarding; position and use of items stowed outside the equipment containers; contents of equipment containers, and warning against tampering. The instructions must be permanently attached and legibly printed on material that is durable and wear resistant. 46 CFR 160.051-4(f) and 160-051-8(b).
- An instruction manual printed on water-resistant material and suspended from one of the canopy arch tubes describing the raft and its equipment including the use of the inflation pump, repair kit, sea anchor, etc. The manual must also contain all of the survival information recommended in IMCO Resolution 181 of October 29, 1969, as amended, together with the illustrated table of lifesaving signals from CG-811(Rev). 46 CFR 160.051-7(b)(3).

- A plastic instruction card suspended from the inside of the canopy (may be in same envelope with the instruction manual) describing the immediate steps to be taken by survivors on entering a raft (as recommended by IMCO Resolution 181). The card must also explain the noise that can be expected to accompany the operation of any CO<sub>2</sub> relief valves that may be installed. 46 CFR 160.0951-7(b)(13).

f. Survival Craft Equipment

(1) First Aid Kits. Directions for the use of first aid kits must be printed in legible type on a durable surface and securely attached to the inside of the kit cover. The specific items to be included in the kit and the directions for their use are provided in 46 CFR 160.041.

(2) Fishing Tackle Kits. A pamphlet of fishing instructions approximately 2-1/2 inches by 4-1/2 inches printed on parchment paper in waterproof ink, with printing on one side of the paper only, must be provided with the kit. The pamphlet must contain a complete description of how and under what conditions each component should be used, and general suggestions for fishing. It must be prepared in easy to read form in such a manner that a completely inexperienced person will know what equipment to use and how to use it. 46 CFR 160.061(i).

(3) Distress Signals. Distress signals must be labeled with information identifying the type of signal, a notice to use only when aircraft or vessel is sighted, and directions for use. 46 CFR 160.01-5, 160.022-5, 160.036-5, 160.037-5, 160.057-5. In the case of some types of signals, more specific requirements for directions are included such as "in black lettering not less than 1/8 inch high in numbered paragraphs, and in simple and easily understood wording."

g. Launching Equipment for Survival Craft

(1) Lifeboats. The only requirement for operating instructions for lifeboat launching equipment is that where mechanical disengaging apparatus is used, the control effecting release of the boat must be painted bright red and have lettered thereon in raised letters either the words "DANGER-LEVER DROPS BOAT" or "DANGER- LEVER RELEASES HOOKS". 46 FR 97.37-37(e). This requirement would also apply to rescue boats and survival capsules.

(2) Rigid Liferrafts, Lifefloats, and Buoyant Apparatus. No requirements.

(3) Inflatable Liferrafts. As previously noted in paragraph 3-2 e(1), instructions for launching and inflating inflatable liferafts must be posted in conspicuous places accessible to the crew and/or passengers and also affixed to the liferaft containers.

h. Line-Throwing Appliances

A set of instructions including a list of equipment information as to proper maintenance, and directions for loading and firing, must be permanently engraved in plastic and mounted conspicuously in the container. 46 CFR 160.031-4(h), 160.040(h).

i. Fire Detection and Alarm Systems

A framed chart or diagram must be installed in the wheelhouse or control station adjacent to the detecting cabinet indicating the location of the various detecting zones and giving instructions for the operation, maintenance, and testing of the system. 46 CFR 76.27-15(f), 76.30-15(f), 76.33-20(g), 76.35-15(e).

j. Firefighting Apparatus and Fire Extinguishing Systems

(1) Firefighting Apparatus. No requirements.

(2) Fire Main System. No requirements.

(3) Fixed CO<sub>2</sub> Systems. Complete but simple instructions for the operation of the systems must be located in a conspicuous place at or near all pull boxes, stop valve controls and in the CO<sub>2</sub> cylinder storage room. On systems in which the CO<sub>2</sub> cylinders are not within the protected space, these instructions must also include a schematic diagram of the system and instructions detailing alternate methods of discharging the system should the manual release or stop valve controls fail to operate. Each control valve to branch lines must be marked to indicate the related space served. 46 CFR 95.15-10(h).

(4) Foam Extinguishing Systems. Complete but simple instructions for the operation of the system must be located in a conspicuous place at or near the controls. 46 CFR 95.17-10(c).

k. Breathing Apparatus

No requirements.

l. Emergency Loudspeaker Systems

An operating instruction plate in letters not less than one-eighth inch high must be provided on the wheelhouse master control station. The instructions must be in sufficient detail to enable a person unfamiliar with the equipment to start, operate, and secure the equipment. An instruction book which includes operating instructions must be provided with the equipment.

m. Emergency Radio Equipment

(1) Survival Craft Radio Equipment (applies to Portable Emergency Radio). Simple instructions suitable for the guidance of unskilled persons must be provided. The instructions must be durably printed on a card which is prominently and permanently attached to the equipment. The instructions, together with sketches, are to cover erecting of the antenna(s) and the operation of the equipment for automatic transmission; also information as to

manual transmission of the international distress signal and the international radio-telegraph alarm signal, and a statement that the latter signal is effective only if transmitted on the frequency 500 kHz. FCC Rules and Regulations 83.556(e).

(2) EPIRB. Concise, unambiguous operating instructions, understandable by untrained personnel, must be conspicuously and permanently displayed on the equipment. Display must be weather resistant, waterproof, and abrasion resistant. FCC Rules and Regulations 83.144(j).

n. Other Lifesaving Equipment

Form CG-811 containing instructions for the use of breeches buoys and the lifesaving signals set forth in IMCO Regulation 16 must be posted in the wheelhouse, the crew's quarters and the engineroom. 46 CFR 97.43-5.

3-3 IMCO REQUIREMENTS FOR SURVIVAL EQUIPMENT OPERATING INFORMATION

The draft revision of Chapter III, Life Savings Systems, of the International Convention for the Safety of Life at Sea, 1960, sets forth the following requirements for operating information:

" Regulation B I/1  
Operational Readiness

(b) Descriptions and instructions for operation, examination, maintenance and functional testing shall be provided for all the life-saving appliances, covering as appropriate:

- (i) purpose;
- (ii) operating principle;
- (iii) physical description;
- (iv) operating instructions;
- (v) requirements for inspection, maintenance, replacements and specialist servicing;
- (vi) requirements for operational testing, standards of performance, methods of adjustment;
- (vii) fault-finding procedures.

- (c) Posters and signs in the vicinity of appliances and controls shall:
  - (i) indicate the purpose of controls and procedures for operating the appliance or controls and give relevant instructions and warnings;
  - (ii) be easily readable under emergency lighting conditions."

### 3-4 SHIPBOARD OPERATING INSTRUCTIONS AND INFORMATION

In order to determine the availability, adequacy, and usefulness of operating instructions and information on board ships, mobile drill rigs, and artificial islands, several ships and rigs were visited. Manufacturers of survival equipment were also contacted to determine what type of operating information was furnished with their equipment. The shipboard and manufacturer-provided operating instructions were analyzed to assess such aspects as readability, ease of understanding, and reading level. The results of this investigation are as follows:

- a. Personal Flotation Devices (PFD)

Although not required, one ship did have a passenger ship poster showing the correct way to don a personal floatation device located in the crew's messroom. No PFD instructions were observed on any drill rig or drill ship visited despite the fact that a large percentage of the personnel on board were not seamen. No posted instructions were observed in any ship or drill rig on the correct way to jump into the water from a height with a PFD.

- b. Lifeboats and Lifeboat Launching Equipment

There were no operating or survival instructions in any lifeboats other than the warning sign on the release lever. There were no instructions on how to start and operate the engine in motor-propelled lifeboats. There were no posted instructions in the vicinity of lifeboat davits on how to launch the lifeboat or recover it.

c. Survival Capsules

Launching and operating instructions were posted inside the capsules observed. The instructions were easy to read but a college graduate, senior engineer reported that he had difficulty understanding them after repeated readings and study.

d. Liferafts

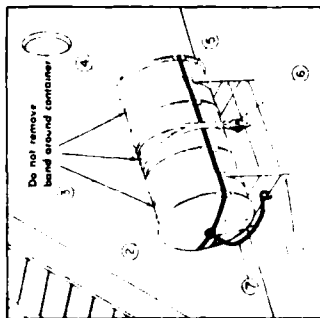
On one ship, large, well-illustrated placards (Figure 3-1) showing how to launch, inflate, and board the liferafts were posted on exterior bulkheads within ten feet of each liferaft. On another ship, the same placard was posted outside the officer's lounge but there were no placards in the vicinity of the liferaft. The instructions and illustrations on this placard were clear and readily understandable. The operating instructions obtained from another liferaft manufacturer (shown in Figure 3-2) are not so clear or understandable. Without some study, it is not apparent that the sequence of instructions is vertical and not from left to right. There are no instructions to cover:

- How to release the raft from its nest in manual operation
- How to get raft over the side in manual operation
- How crewmen are to get from the ship to the raft
- Location of knife to cut painter

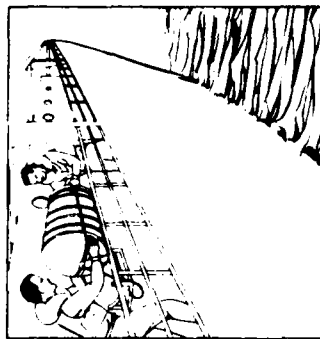
Other problems with the instructions are that the white printing is difficult to read and that crewmen are not shown wearing lifejackets.

Placards are also required on the liferaft container itself. In one instance, a liferaft placard was illegible as a result of weathering. In another instance the position of the liferaft and the orientation of the placards was such that it was virtually impossible to read them. On another ship, the instructions for releasing the raft from its nest were for a different type releasing mechanism and did not apply to the mechanism which secured that raft.

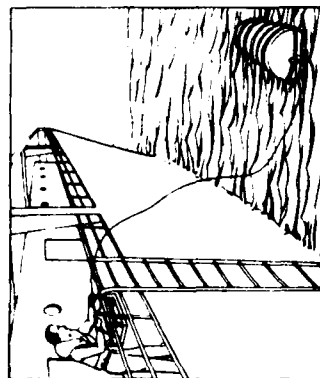
## MANUAL OPERATION



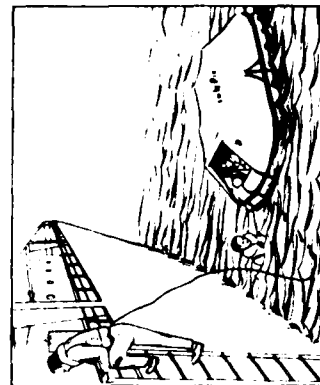
- 1 Cradle
- 2 Inflatable Life Raft
- 3 Tie Down Straps
- 4 Stainless Steel Packing Bands
- 5 Fiber Glass Container
- 6 Hydraulic Release
- 7 Painter/Lanyard



- 1 Pull hook open at hydraulic release to release tie down straps.
- 2 Leave painter/lanyard attached to cradle. Keep away from tangling in painter/lanyard.
- 3 DO NOT REMOVE band around container - They will snap when painter/lanyard is pulled.
- 4 Throw raft over board.

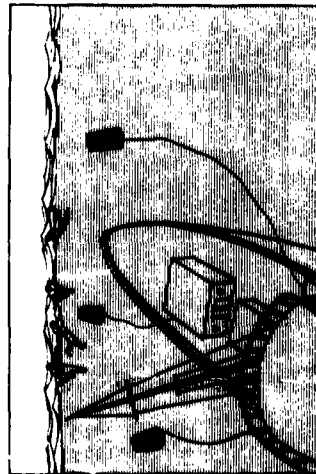


- 1 With raft and case in water, pull operating painter/lanyard. Bands will break and raft will inflate.
- 2 Leave painter/lanyard attached to cradle.

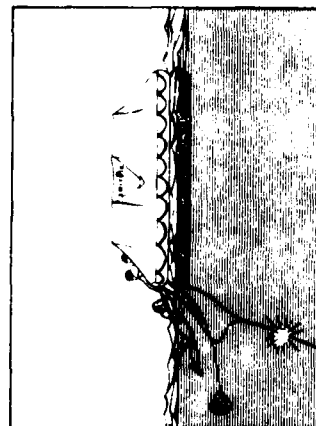


- 1 Raft will inflate out of the container as shown.
- 2 Board raft immediately.
- 3 Remove knife from pack on canopy.
- 4 Cut raft painter/lanyard from vessel.
- 5 Follow survival instructions inside raft. Read manuals thoroughly.

## AUTOMATIC OPERATION



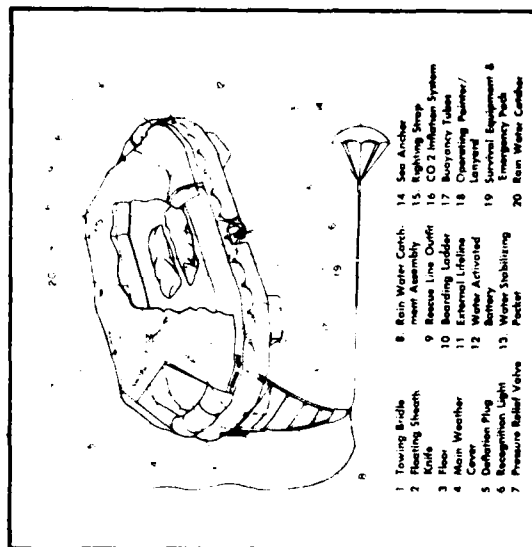
After vessel sinks to depth of 10-15 ft, hydraulic trip releases storage case which ascends to the surface.



Raft completely inflated and ready for boarding within 30 seconds. Buoyancy of raft ensures painter/lanyard is kept.

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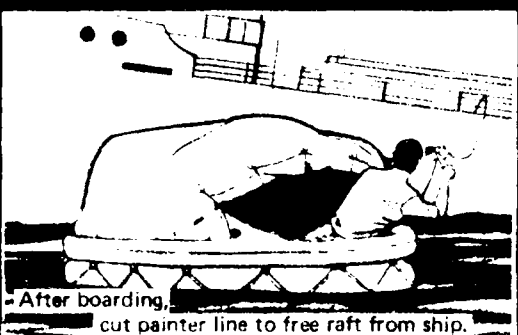
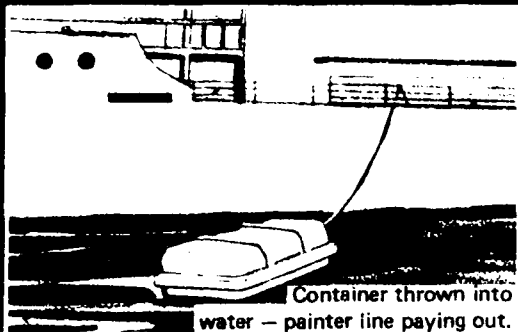
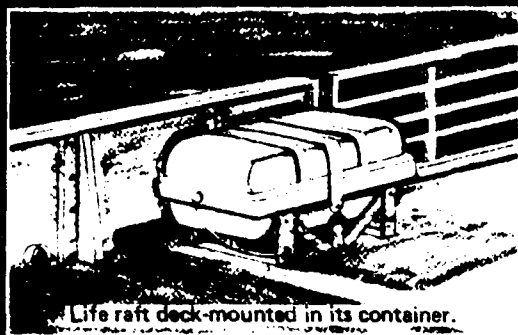
- 1 Towing Bridle
- 2 Flaming Sheath
- 3 Knife
- 4 Rain Weather
- 5 External Lifeline
- 6 Deflation Plug
- 7 Recognition Light
- 8 Rain Water Catchment Assembly
- 9 Rescue Line Outfit
- 10 Boarding Ladder
- 11 External Lifeline
- 12 Water Activated Lanyard
- 13 Water Stabilizing
- 14 Sea Anchor
- 15 Righting Strap
- 16 CO 2 Inflation System
- 17 Buoyancy Tubes
- 18 Operating Painter/Lanyard
- 19 Survival Equipment & Manuals
- 20 Rain Water Catchment

Figure 3-1. Example of Adequate Liferaft Operating Instructions  
(Actual Size 14" x 20")



## OPERATIONAL SEQUENCE

MANUAL



AUTOMATIC

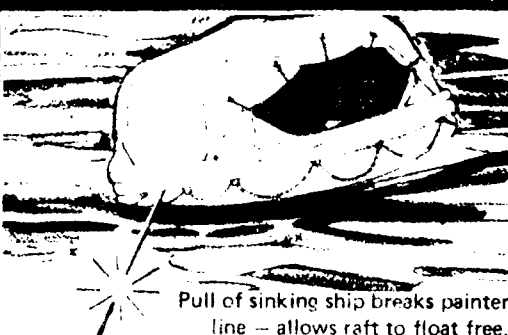
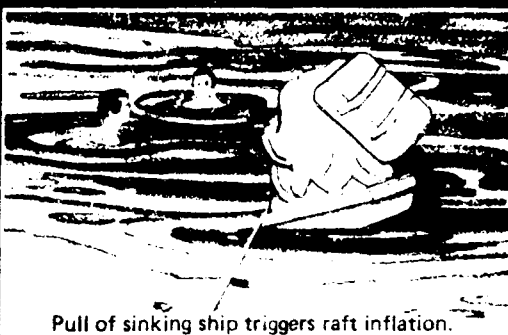
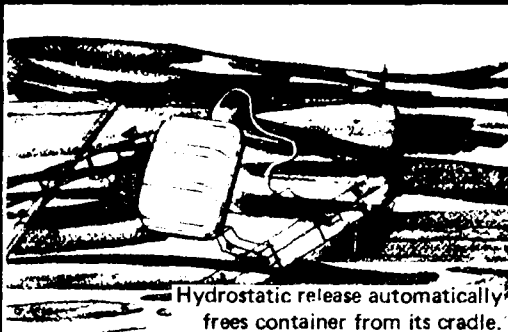
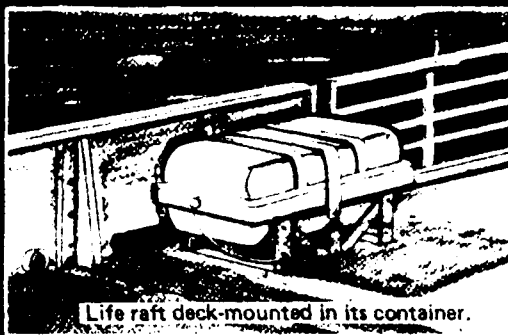


Figure 3-2. Example of Poor Liferaft Operating Instructions

The placard affixed to one type of liferaft included the following instruction:

"2. Before launching the liferaft by hand pull out the nylon line from the container and make fast to the cleat."

The only line visible on the exterior of the container is a small steel cable. There is no marking on the container or cable to indicate what the purpose of the cable is. In fact, it is attached to the nylon line referred to in the instruction. Only after pulling out approximately 2 feet of cable does the nylon line become visible.

e. Line Throwing Appliance

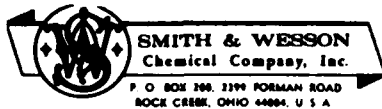
Figure 3-3 shows the operating instructions for one type of line throwing appliance which were found posted on the bridge of two ships. The type is large and easy to read, but the instructions are not as clear as they might be. The illustration should be labeled to point out "auxiliary rope," "looped end of service line," and "loop on wire tail of rocket" as these terms are not self explanatory. Instruction 5 is actually two instructions in reverse order. They should be written as separate steps in the proper sequence. The instruction to oil gun is not adequate in that it does not specify the type of oil or the parts to be oiled.

f. Fire Detection and Alarm Systems

Operation of alarm panels was readily apparent from labels on indicator lights and controls. Lists of location of detectors were adequately readable and understandable.

g. Firefighting Apparatus and Fire Extinguishing Systems

(1) Portable Extinguishers. Most ships had no operating instructions other than those affixed to the container which provide instructions for activating the extinguisher. One ship had additional posted placards (see



## OPERATING INSTRUCTIONS

1. OPEN LINE BOX BY REMOVING TOP LID.
2. TIE AUXILIARY ROPE TO LOOPED END OF SERVICE LINE TAGGED BLUE. (DO NOT INTERFERE WITH LAY OF LINE IN BOX).
3. CONNECT RED TAGGED END OF LINE TO THE LOOP ON WIRE TAIL OF ROCKET.
4. OPEN BREECH OF GUN AND INSERT CARTRIDGE.
5. INSERT ROCKET INTO BARREL OF GUN FIRST REMOVING SEAL AT BASE OF ROCKET.
6. MAKE SURE THAT WIRE TAIL CONNECTED TO LINE IS ALLOWED TO HANG FREE WITH NO OBSTRUCTION. SEE ILLUSTRATION.
7. STAND BEHIND LINE BOX AND AIM GUN AT APPROXIMATELY 45° HOLDING GUN AS ILLUSTRATED WITH BOTH HANDS.
8. HOLDING GUN FIRM SQUEEZE TRIGGER TO LAUNCH ROCKET.
9. THE ROCKET WILL LEAVE THE MUZZLE THE INSTANT THE GUN IS FIRED.
10. THE RECOIL IS NOT MORE THAN THAT OF A HAND GUN.
11. OIL GUN AND SEE ALL GEAR CLEAN AND IN GOOD ORDER BEFORE PUTTING AWAY.
12. WARNING! NOT TO BE FIRED WITHOUT LINE ATTACHED.
13. FOR PRACTICE USE, DO NOT FIRE WITH LESS THAN 30 METERS (100 ft.) OF SERVICE LINE ATTACHED.

Rev. 7/79



## Reminder

### CARGO AND MISCELLANEOUS VESSELS 97.15-25

On vessels fitted with a line throwing appliance, it shall be the duty of the Master to drill his crew in the use of such appliances, and require it to be fired at least once in every three (3) months. Each drill shall be recorded in the vessel's official log book.

Made in U.S.A.

Figure 3-3. Example of Line Throwing Appliance Operating Instructions

Figure 3-4) on the bulkhead over each extinguisher providing information on the type of extinguisher, the types of fire to use it on, and the types not to use it on. The placard is considered to be an excellent aid to training in and use of portable extinguishers.

(2) Fixed CO<sub>2</sub> System. The instructions for system operation were white printing on red bakelite. On one ship they were reported to be difficult to read because of the small size of the printing. There was no emergency lighting available to permit reading if power were lost. All instructions required considerable study in order to fully understand operation. In one CO<sub>2</sub> room, the ship had added instructions and color coded valves in order to clarify and amplify the instructions furnished by the manufacturer.

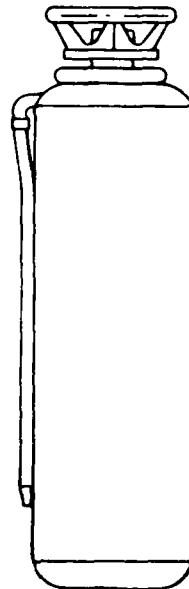
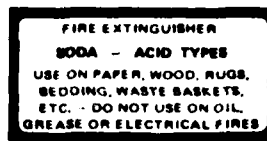


Figure 3-4. Example of Operation Information Placard for Portable Fire Extinguishers

(3) Fire Main System. There were no posted instructions at fire main stations.

(4) Breathing Apparatus. Printed instructions were located inside the cover of the container. They were lengthy, detailed, and difficult to understand.

(5) Flame Safety Lamp. No operating instructions were found for flame safety lamps.

h. Emergency Loudspeaking Systems

None of the ships visited had emergency loudspeaking systems. One ship reported that system had been removed because of continuing maintenance problems.

i. Portable Radio

The operating instructions for one type of portable radio are printed in a small manual located inside the cover of the radio. Readability was good. The instructions for another type of portable radio were printed on the side of the cover. The small size of the lettering and the dark background made them difficult to read. Both sets of operating instructions were written at high school or higher reading level and required considerable study for full understanding.

3-5 SUMMARY OF DEFICIENCIES IN SHIPBOARD OPERATING INSTRUCTIONS AND INFORMATION

In general, there is a lack of clear, concise, well-illustrated, easily-readable operating instructions and information on survival equipment and procedures posted at locations where they would be most useful. Coast Guard requirements for operating instructions and information are inconsistent in that there are very specific and detailed requirements in some cases and no requirements in others. Based on the shipboard surveys, the following are the principal types of deficiencies in survival equipment operating instructions and information.

a. Availability of Posted Operating Instructions and Information

There are no posted instructions or information for the following:

- Proper way to wear life preserver (particularly needed on drill ships and rigs).
- Proper way to jump into water from a height while wearing PFD.
- How to start and operate a lifeboat engine.
- Survival techniques in a lifeboat, such as rationing, use of distress signals, visual communication methods, exposure avoidance, use of seafood, etc.
- How to launch and recover lifeboats.
- Types of fires on which different types of portable fire extinguishers should be used.

- Operation of fire main stations, particularly use of combination nozzles and fog applicators.
- Operation and use of flame safety lamp.
- Hypothermia, how to minimize effects.

b. Location of Posted Operating Information

Operating information is not always located where it will be immediately available when needed. An example of this is the location of instructions for launching, inflating, and boarding liferafts in living quarters and not at liferaft stations.

c. Readability

Operating instructions are not always easily readable, particularly under limited lighting conditions, either as a result of lettering being too small or being on a poor background. Other readability problems result from weathering and visually inaccessible location of placards. Emergency lighting may not be available where needed, such as in CO<sub>2</sub> rooms.

d. Ease of Understanding

Some operating instructions are not written clearly or concisely or in easy-to-follow step-by-step sequence. Illustrations, arrows, color coding, and other graphic methods are not used as often as they might be to aid understanding. Examples of difficult to understand instructions noted in ship visits include operating placards for fixed CO<sub>2</sub> systems, survival capsules, and portable radios.

e. Incorrect Instructions

Two instances were observed in which posted operating instructions did not provide correct instructions for manual launching of a liferaft.

## SECTION 4 MAINTENANCE INFORMATION AND PERFORMANCE

### 4-1 MAINTENANCE REQUIREMENTS AND LOG ENTRIES

In Table 4-1 which follows, maintenance requirements for survival equipment or appliances which are required by the U.S. Coast Guard or other regulatory agencies or are recommended by manufacturers are summarized. Where IMCO requirements differ markedly from U.S. regulatory requirements, they are noted. The regulatory requirements do not include the inspections of lifesaving and firefighting equipment performed by Coast Guard inspectors at annual and biennial inspections. These are discussed in paragraph 4-2.

The following tests and inspections of survival equipment must be entered in the deck log:

- Swinging out and lowering of lifeboats and tests of lifeboat engines and hand-propelling gear together with a statement as to the condition of all fire and lifesaving equipment 46 CFR 97.15-35
- Monthly examination of lifeboat equipment 46 CFR 97.15-35
- Quarterly test of line throwing appliance 46 CFR 97.15-25
- Quarterly examination of electric power-operated lifeboat winches 46 CFR 97.15-40
- Separate reports of tests and inspections of firefighting equipment to be kept with ship's log 46 CFR 97.15-60

Table 4-1. Maintenance Requirements for Survival Equipment/Appliances

SURVIVAL EQUIPMENT/APPLIANCE	MAINTENANCE REQUIREMENTS	FREQ.	SOURCE	ACCOMP. BY
Personal Flotation Devices	None			
Exposure Suits	<u>Regulatory Requirements</u> None <u>Manufacturer Requirements (Typical)</u> Wash with soap and water, dry, lubricate zipper after use	When necessary	Mfg.	Ship or Shore
Lifeboats	<u>Regulatory Requirements</u> Remove covers and strongbacks, put plugs and caps in place, operate motor or hand-propelling gear ahead and astern for not less than 5 minutes.  Examine hydraulic starting system for leaks.  Examine equipment to insure it is complete.  Ensure each lifeboat is lowered to the water at least once in 3 months.  Strip, clean, and thoroughly overhaul. Empty fuel tanks. Change fuel.  <u>Manufacturer Requirements (Typical)</u> Lubricate throttle and steering control linkage. Lubricate release gear mechanism. Inspect engine oil and cooling system levels.  Perform engine annual maintenance.	Weekly  Weekly  Monthly  Quarterly  Annually  Monthly  Annually	46 CFR 97.15-35  NVIC 5-77  46 CFR 97.15-35  46 CFR 97.15-35  46 CFR 97.15-45  Mfg. Inst. Book  Mfg. Inst. Book	Ship  Ship  Ship  Ship  Ship or Shore  Ship  Ship or Shore

CFR — Code of Federal Regulations  
NVIC — Navigation and Vessel Inspection Circular



**Table 4-1. Maintenance Requirements for Survival Equipment/Appliances  
(Continued)**

<b>SURVIVAL EQUIPMENT/ APPLIANCE</b>	<b>MAINTENANCE REQUIREMENTS</b>	<b>FREQ.</b>	<b>SOURCE</b>	<b>ACCOMP. BY</b>
Survival Capsules	<u>Regulatory Requirements</u> Regulatory requirements are the same as for lifeboats, as applicable.			
	<u>Manufacturer Requirements (Typical)</u> Recharge hydraulic system. Inspect engine oil level. Turn sprinkler pump by hand. Operate rudder.	Weekly	Mfg.	Rig
	Lubricate release gear. Inspect mechanical and material condition of exterior and interior components. Inspect battery water level and charge.	Monthly	Mfg.	Rig
	Lubricate throttle and steering control linkages. Clean engine air filters. Renew engine lube oil and filter.	Semi-annual	Mfg.	Rig
	Perform engine annual maintenance. Renew hydraulic system filter. Inspect holding and launch platform. Lubricate sprinkler system pump.	Annually	Mfg.	Authorized Service Facility
Inflatable Liferafts	<u>Regulatory Requirements</u> Liferaft to be serviced by an approved service facility.	Annually	46 CFR 97.15-45	Approved Service Facility
	Hydraulic release to be serviced and tested and springs renewed.	Annually	46 CFR 91.25-15	Approved Service Facility
	<u>Manufacturer Requirements (Typical)</u> There are no requirements for servicing by shipboard personnel.			
Survival Craft Equipment	<u>Regulatory Requirements</u> Renew items such as distress signals, drinking water, and provisions that have reached service-life limitation.	Annually as required	46 CFR 94.20	Ship or Shore

**Table 4-1. Maintenance Requirements for Survival Equipment/Appliances  
(Continued)**

SURVIVAL EQUIPMENT/ APPLIANCE	MAINTENANCE REQUIREMENTS	FREQ.	SOURCE	ACCOMP. BY
Launching Equipment for Survival Craft	<u>Regulatory Requirements</u>			
	In-Port – Swing out boats. Lower unobstructed boats to water.	Weekly	46 CFR 97.15-35	Ship
	Underway – Swing out boats.	Weekly	46 CFR 97.15-35	Ship
	Examine all lifeboat winch control apparatus including motor controllers, emergency switches, master switches and limit switches. Remove drain plugs or open drain valves.	Quarterly	46 CFR 97.15-40	Ship or Shore
	Ensure that each lifeboat is lowered to the water at least once in 3 months.	Quarterly	46 CFR 97.15-35	Ship
	<u>Proposed IMCO Requirements Not Included in U.S. Regulations</u>			
	Turn wire rope falls end for end.	Every 2 years	SOLAS Chapter III draft, reg. C1/12	Shore
	Renew wire rope falls.	Every 4 years	SOLAS Chapter III draft, reg. C1/12	Shore
	<u>Manufacturer Requirements (Typical)</u>			
	Check winch oil level.	Weekly	Mfg.	Ship
	Lubricate wire rope falls, sheaves, rollers, and lever bar.	Monthly	Mfg.	Ship
	Inspect wire rope falls, sheaves, and sheave bushing.	Every 60-90 days	Mfg.	Ship
	Change winch oil.	Every 6 mos.	Mfg.	Ship
	Renew wire rope falls when broken strands appear or diameter reduced to 2/3 original size.	When req'd	Mfg.	Shore

**Table 4-1. Maintenance Requirements for Survival Equipment/Appliances  
(Continued)**

<b>SURVIVAL EQUIPMENT/ APPLIANCE</b>	<b>MAINTENANCE REQUIREMENTS</b>	<b>FREQ.</b>	<b>SOURCE</b>	<b>ACCOMP. BY</b>
<b>Line Throwing Appliances</b>	<u>Regulatory Requirements</u> Test by firing.	Quarterly	46 CFR 97.15-25	Ship
	<u>Manufacturer Requirements (Typical)</u> Clean and oil after firing.	Quarterly	Mfg.	Ship
<b>Fire Detection and Alarm Systems</b>	<u>Regulatory Requirements</u> Test at least 25 percent of detecting thermostats to detect any change in operating characteristics.	Annually	46 CFR 111.05-10	Ship
	<u>Manufacturer Requirements (Typical)</u> Inspect and clean detector head screen. Test system.	Semi- annual	Mfg.	Mfg. rep.
	Test entire system.	Annually	Mfg.	Mfg.

**Table 4-1. Maintenance Requirements for Survival Equipment/Appliances  
(Continued)**

SURVIVAL EQUIPMENT/APPLIANCE	MAINTENANCE REQUIREMENTS	FREQ.	SOURCE	ACCOMP. BY
Firefighting Apparatus and Extinguishing Systems	<u>Regulatory Requirements</u>			
	Operate fire pumps and fire stations.	Weekly	46CFR 97.15-35	Ship
	Inspect CO2 portable extinguishers to ensure they are in designated places, not tampered with or actuated, and no physical damage or corrosion.	Monthly	NVIC 7-70	Ship
	Conduct tests and inspections of all hand portable fire extinguishers, semiportable fire extinguishing systems, and fixed fire extinguishing systems on board as described in Tables 91.25-20(a)(1) and 91.25-20(a)(2).	Annually	46 CFR 97.15-60	Authorized Shore Facility
	<u>Manufacturer Requirements (Typical)</u>			
	Make inspection of entire system for damage or obstruction of nozzles and piping.	Monthly	Mfg.	Ship
	Lubricate foam system station monitor.	Quarterly	Mfg.	Ship
Breathing Apparatus	Make an inspection of automatic or manual release equipment.	Semi-annual	Mfg.	Ship
	Have system inspected by manufacturer's representative.	Annual	Mfg.	Mfg. rep.
	<u>Regulatory Requirements</u>			
	Maintain in operative condition.	—	46 CFR 96.35-5	Ship or Shore
	Inspect. Clean after each use.	Monthly & after each use	OSHA 1910.134 Para. B	Ship
	<u>Manufacturer Requirements (Typical)</u>			
	Deliver apparatus to manufacturer for inspection and test.	Annual	Mfg.	Mfg.

**Table 4-1. Maintenance Requirements for Survival Equipment/Appliances  
(Continued)**

<b>SURVIVAL EQUIPMENT/ APPLIANCE</b>	<b>MAINTENANCE REQUIREMENTS</b>	<b>FREQ.</b>	<b>SOURCE</b>	<b>ACCOMP. BY</b>
<b>Emergency Loudspeaker System</b>	<u>Regulatory Requirements</u> Conduct operating test (must be made by trained officer and logged).	Weekly	46 CFR 113.50-35	Ship
	<u>Manufacturer Requirements (Typical)</u> Inspect loudspeakers for tightness of connections and fasteners, watertight integrity and deterioration.	Semi-annually	Mfg.	Ship
<b>Emergency Radio Equipment</b>	<u>Regulatory Requirements</u> Portable Radio — Test using a suitable artificial antenna. Recharge batteries (if installed).	Weekly	46 CFR 97.15-50	Ship
	EPIRB — Test using the integrated test circuit and output indicator.	Monthly	46 CFR 97.15-65	Ship
	EPIRB — Replace battery after the EPIRB is used and before the date required by FCC regulations in 47 CFR Part 83 to be marked on the outside of the EPIRB.	When required	46 CFR 97.15-65	Ship
	<u>Manufacturer Requirements (Typical)</u> Portable Radio — Test. Inspect and renew desiccant when indicated by change in color.	Weekly	Mfg.	Ship
	EPIRB — Return to manufacturer for test and replacement of battery.	When required	Mfg.	Mfg.
	<u>IMCO Requirements Not Included in U.S. Requirements</u> Portable Radio — Test in a survival craft afloat when possible.	Whenever possible	IMCO Conf. 1978	Ship
	Portable Radio — Test in a survival craft on board ship.	Quarterly	IMCO Conf. 1978	Ship

#### 4-2 U.S. COAST GUARD INSPECTIONS

At intervals of 1 or 2 years, vessels are inspected for reissuance of certificates of inspection. During these inspections, lifesaving equipment and appliances and firefighting equipment are inspected in accordance with the detailed requirements contained in 46 CFR 91.25-15 and 91.25-20 and guidance in various Navigation and Vessel Inspection Circulars (NVIC). While on the one hand these inspections are responsible for the discovery and correction of many unsafe conditions, on the other hand, according to a recent GAO report, the inspections are not fully effective because of understaffing and lack of adequate training and qualification of inspectors.

#### 4-3 SOLAS MAINTENANCE MANUALS REQUIREMENT

The draft revision of Chapter III, Life Savings Systems, of the International Convention for the Safety of Life at Sea, 1960, prepared in September 1978 sets forth the following requirements for maintenance manuals for survival equipment:

##### "Regulation D VII/2

"Maintenance manuals for life-saving appliances shall include, as appropriate for each appliance, the following:

- (a) a check list for use when carrying out inspections in accordance with Regulation C I/12(c); (monthly inspection of all components of the lifesaving system);
- (b) maintenance and repair instructions;
- (c) schedule of periodic maintenance;
- (d) diagram of lubrication points with the recommended lubricants;
- (e) list of replaceable parts;
- (f) list of sources of repair parts;
- (g) log for records of inspections and maintenance."

#### 4-4 SHIPBOARD MAINTENANCE INFORMATION

The availability and adequacy of documented or posted information on board ships or rigs to support maintenance of survival and firefighting equipment was investigated by means of a survey of survival equipment maintenance manuals and by shipboard visits.

##### a. Survey of Survival and Firefighting Equipment Maintenance Manuals

Thirty manufacturers or distributors of survival and firefighting equipment or appliances were contacted and requested to provide information on maintenance manuals or other forms of maintenance information which they provide with their equipment. Eighteen companies furnished information in reply. In addition, maintenance manuals on survival and firefighting equipment were obtained from other sources for study. At least one manufacturer's manual was obtained for each type of equipment or appliance other than personal flotation devices, inflatable liferafts, and survival craft equipment. The following are the principal characteristics of the manuals reviewed.

- There is no standard format or organization of contents, however, nearly all manuals contain sections on installation, operation, maintenance, and spare parts.
- The quality and readability of the manuals varies widely. Some are profusely illustrated with photographs and diagrams and printed in large easily-read type on heavy bond paper. Others, principally those for lifeboat davits, are typewritten and duplicated and use copies of reduced-size fold-out blueprints for illustrations. Some of the latter are difficult to read.
- The instructions for routine preventive maintenance range from very explicit, detailed instructions to very general, vague instructions. Whereas one manual provides specific criteria for inspection of wire rope

falls, another merely says to inspect them and renew them if necessary. In a few cases, manuals specify "periodic" tests or inspections rather than specific time intervals.

- In one manual, for a survival capsule, all the maintenance requirements are summarized in a single chart. In other manuals it is necessary to look in several different places, or even in other manuals, to locate all the maintenance requirements.
- Lubrication charts are provided, usually in the form of copies of reduced-size blueprints. In some cases it is difficult to determine the location of lubrication points from the drawings. In one manual, the user is required to refer to two other manuals to obtain lubrication charts.

b. Shipboard Maintenance Information Survey

The Chief Mates aboard two ships visited stated that they did not have any sources of maintenance information for survival and firefighting equipment other than the tests and inspections contained in Coast Guard regulations. No posted maintenance instructions or lubrication charts were found on any ship or rig visited.

4-5 MAINTENANCE RESPONSIBILITIES, PROGRAMS, AND RECORDS

As a general rule, aboard merchant ships, the Chief Mate is responsible for the maintenance of all survival equipment and appliances with the exception of fixed CO<sub>2</sub> systems which are customarily the responsibility of the Chief Engineer. If equipment requires maintenance or repairs which are beyond the capability of the Chief Mate, they are furnished by the Chief Engineer or shore repair services are requested.



On board stationary drill rigs, maintenance of survival and firefighting equipment is the responsibility of the Toolpusher, however, nearly all maintenance of such equipment is performed by manufacturers' representatives.

Of the six ships and two drilling platforms visited, only one, a drill ship, had a documented program for maintenance of survival equipment. This program was part of the MarAd "Shipboard Maintenance and Repair System" which is described in a subsequent paragraph. A Chief Mate on a containership stated that he kept a record of survival equipment inspections and lubrication. A tanker company requires its ships to keep a permanent record of survival equipment tests and inspections (but not other maintenance) on a form which is kept with the deck log.

The "Shipboard Maintenance and Repair System" developed by the Maritime Administration provides simple procedures and forms for planning, scheduling, and recording of accomplishment of preventive maintenance. The specific maintenance actions to be performed are developed individually for each ship and each item of equipment, including survival equipment. The system has been installed and successfully evaluated on board two different types of merchant ships (MarAd Report Nos. MA-RD--920-78042 and 79052) and is now being used as a basis for shipboard and drill rig maintenance programs by a number of shipping and drilling companies. A sample of a maintenance planning and recording form used by the system covering survival equipment is shown in Figure 4-1.

#### 4-6 MAINTENANCE PERFORMANCE

Survival and firefighting equipment on board the ships and drill rigs visited were inspected to determine the extent to which maintenance was or was not being performed. In general, the regulatory maintenance requirements were

# MAINTENANCE PLAN AND RECORD

SYSTEM/EQUIPMENT DECK		CALENDAR MAINTENANCE		1979												1980												DUE ON NEXT PLAN
MA CODE	MAINTENANCE ACTIONS	FREQ	LAST DONE FROM PLAN	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
	MOTOR LIFEBOAT (PORT) (CONT'D) 355-02																											
	4. Pump. Inspect and test.																											
E	Air System. Inspect.	SA																										
	1. Pressure controller. Inspect. Assure operational.																											
F	Provisions. Inventory.	A	2-79																									
G	Lifeboat. Inspect. International regulations require that lifeboats be examined and repaired at least every two years in order to qualify for a safety certificate.	A	12-78																									
	LIFEBOAT DAVIT (STARBOARD) 356-01																											
A	Gearcase. Inspect oil level.	M																										
B	Gravity Davits and Winch. Inspect and lubricate.	M																										
	1. Sheaves																											
	2. Rollers																											
	3. Levers and grips																											
	4. Securing hooks																											
	5. Swivels																											
C	Brake Lever Busses. Lubricate.	M																										
D	Davit Arm Securing Hooks. Assure hooks screw in and out and pivot freely.	M																										

FREQUENCY CODES M MONTHLY B BIRGHTLY Q QUARTERLY SA SEMI-ANNUALLY A ANNUALLY — EVERY — YEARS

Figure 4-1. Shipboard Maintenance and Repair System Maintenance Plan and Record Form for Survival Equipment

being complied with, but many of the manufacturer requirements were not. Examples of lack of maintenance which were observed are as follows:

- The sheaves on a lifeboat davit were frozen. No action was taken to free them. The lifeboat was hoisted by running the falls over the frozen sheaves.
- Lifeboat falls not lubricated in areas where the falls were not accessible with lifeboat in stowed position.
- Lifeboat winch grease fittings painted over. No evidence of recent application of grease.
- Lifeboat bilge pump inoperative.
- Lifeboat releasing gear in need of lubrication.
- Gate providing access to fenced-in liferaft could not be opened because of excess paint, corrosion, and lack of lubrication.
- Equipment missing from fire main hose stations, such as spanner wrenches, applicators, and hose. On one ship, all hose for topside stations except one 25-foot length were stowed in the emergency gear locker. Took mate 5 minutes to locate key to locker.

- Emergency gear locker not properly stowed. Emergency tools, breathing apparatus, and other items in pile on deck.
- Safety pins missing from CO<sub>2</sub> fire extinguishers.

#### 4-7 SUMMARY OF DEFICIENCIES IN SHIPBOARD MAINTENANCE INFORMATION

##### a. Maintenance Manuals

The majority of the manuals are adequate for their purpose. The principal deficiencies are illegible lubrication drawings; the lack, in a few cases, of specific maintenance frequencies; and the lack of a single chart or table detailing all maintenance requirements and frequencies for a particular piece of equipment.

##### b. Shipboard Maintenance Information

Shipboard and drilling rig observations appear to indicate that, on most ships and rigs, the Chief Mate or other individual responsible for maintenance of survival equipment does not have adequate maintenance information available to him.

##### c. Maintenance Programs and Records

Lack of well-defined programs of maintenance for survival and firefighting equipment and a means to maintain a written record of the status of accomplishment would appear to be a major factor in the unsatisfactory material conditions observed in some equipment.

##### d. Maintenance Performance

Based on the limited observations conducted, maintenance performance appears to be most lax in the areas of lubrication and corrosion control of lifeboats and lifeboat launching gear. Inadequate maintenance of this equipment is supported by reports of marine casualties and articles in the Proceedings of the Marine Safety Council. Other areas of neglect noted were fire main station equipment, fire extinguishers, and emergency gear locker stowage.

## SECTION 5

### TRAINING

#### 5-1 TRAINING RESPONSIBILITIES

The responsibility to ensure that U.S. merchant vessels are manned by properly trained and qualified personnel is jointly shared by the Maritime Administration and the U.S. Coast Guard. The Maritime Administration is responsible for the conduct of training and the provision of training materials. The Coast Guard is responsible for determining that individuals are qualified to safely perform the tasks and responsibilities of the license or certificate issued to them. (Coast Guard/Maritime Administration Policy Statement concerning Qualifications of crews of United States Merchant Vessels, 6 Sep. 1974.)

Within the industry, training responsibilities are also shared between the operator and the union. The operator has a legal responsibility as well as a self-serving interest to ensure that the crew is fully trained to meet all emergencies. However, because of the terms of most union contracts, operators generally delegate this responsibility to the union, reasoning that they are paying the union to provide them with trained personnel.

Aboard ship, the ultimate responsibility for organizing and training the crew for emergencies rests with the master (or person in charge on drill rigs). The master's responsibilities are spelled out in U.S. Coast Guard regulations 46 CFR 97.13-20 and 97.15-35.

As a result of the fragmentation of training responsibilities, shore training is conducted by a number of different and largely autonomous organizations without any single overall authority. These training organizations include Maritime Administration schools, Federal and State Maritime academies, union

schools, and college, university, and private training schools and courses. The Maritime Advisory Training Board, a nonprofit organization of representatives from management, labor, and government groups interested and involved in maritime training, was created to help fill the gap between the various maritime training organizations, but can act only in an advisory capacity. Its functions include:

- Serving as a focal point for interchange of information and as an advisory board on matters affecting maritime training.
- Reviewing training proposals and making appropriate recommendations to MarAd, U.S. Coast Guard and other appropriate agencies.
- Reviewing and recommending improvement of maritime training programs.

#### 5-2 TRAINING REQUIREMENTS

##### a. U.S. Regulatory Requirements

The U.S. Coast Guard regulations which specifically require shipboard training are:

- 46 CFR 97.13-20. Master to instruct crew.  
This regulation requires the master to conduct drills and give instructions as necessary to ensure that all hands are familiar with their emergency duties as set forth in the ship's station bill.
- 46 CFR 97.15-35. Fire and boat drills.  
This regulation requires the master to conduct a fire and boat drill at least once a week. If more than 25 percent of the crew have been replaced at a port, the drill must be held within 24 hours of leaving port. The drill requirements include:
  - Conducting drill as if an actual emergency existed.
  - All hands reporting to assigned stations prepared to perform prescribed duties.
  - Operation of fire pumps and stations.
  - Breaking out rescue and safety equipment and demonstrating ability to use.
  - Operating watertight doors.

- Preparing lifeboats for launching and operating their engines or hand-propelling gear.
- Participation by passengers.
- In port, lowering unobstructed lifeboats into water and operating them with crewmembers embarked.

b. IMCO and SOLAS Requirements

The requirements of the IMCO International Convention on Standards of Training, Certification, and Watchkeeping for Seafarers, 1978 and the September 1978 draft revision of Chapter III of the International Convention for the Safety of Life at Sea, 1960 related to training in survival techniques and firefighting are summarized in the following paragraphs:

(1) Certification Requirements from the International Convention on Standards of Training, Certification, and Watchkeeping

- In order to obtain certification as master, chief mate, officer-in-charge of a navigation watch, chief engineer, second engineer or engineer officer-in-charge of a watch, the officer must have attended an approved practical fire-fighting course.
- Ratings forming part of a navigational watch or an engineroom watch must have training in firefighting, first aid, and survival techniques.
- All officers and ratings of oil tankers, chemical tankers, and liquid gas tankers must attend an approved basic or advanced firefighting course.
- Resolution 19 recommends that every prospective seafarer be given training in survival techniques before being employed on a sea-going ship.

- The convention includes comprehensive experience, ability, and knowledge requirements for certificates of proficiency in survival craft.

(2) On-Board Training and Drill Requirements from draft revision of Chapter III SOLAS

- A training manual on operation and use of survival equipment is to be provided in each crew messroom and recreation room or in each crew cabin.
- Each crewmember must participate in at least one drill every month.
- A fire and boat drill must be conducted within 24 hours after leaving port if more than 25 percent of the crew have not participated in a drill on board that particular ship in the past month.
- Fire and boat drills must be conducted as if an actual emergency exists.
- Each lifeboat must be launched and maneuvered in the water with its assigned crew aboard at least once every two months, if possible.
- Lifeboat equipment must be examined at least once a week.
- If rescue boats separate from lifeboats are provided, they must also be launched and maneuvered with assigned crew aboard once every two months, if possible.
- Emergency lighting for lifesaving appliances must be tested at each boat drill.

- On-board training in the use of lifeboat equipment and lifesaving appliances on board must be given as soon as possible and not later than two weeks after a crew member joins the ship.
- Instructions in the use of the lifesaving appliances on board must take place at the same interval as the fire and boat drills. Each member of the crew must receive this instruction, which must include instruction covering the problems of hypothermia, first aid treatment for hypothermia and other appropriate first aid procedures, and any special instructions needed for use of the lifesaving appliances in severe weather and sea conditions. Individual instructions may cover different parts of the lifesaving system, but all the lifesaving equipment and appliances must be covered within any two-month period.

As can be seen from the foregoing, Convention on Standards of Training, Certification, and Watchkeeping for Seafarers, 1978 and draft SOLAS Chapter III requirements are considerably more comprehensive and stringent in most respects than corresponding U.S. regulatory requirements.

#### 5-3 INITIAL AND UPGRADING TRAINING

Entry level seamen are not required to have any preliminary survival training or demonstrate any knowledge of the operation or use of survival equipment in order to obtain their initial merchant mariner's documents. One union school, the SIU's Harry Lundeberg school, does, however, provide its entry level seamen with survival training and require them to pass the U.S. Coast Guard examination for lifeboatmen in order to graduate.



Seamen who wish to obtain able seaman or lifeboatman certificates are required to demonstrate their knowledge of the launching and operation of lifeboats by test and by actual demonstration of their ability to command a lifeboat. Unlicensed engineering personnel upgrading to QMED (qualified member of the engine department) are tested on their knowledge of the use of firefighting equipment. Other than the aforementioned, there are no requirements for initial or refresher survival training for unlicensed personnel.

Licensed personnel who are graduates of maritime academies or union schools receive survival training including practical firefighting training during their course of instruction. Other licensed personnel may or may not receive such training. There is no regulatory requirement for licensed personnel to receive initial or refresher survival training except in the sense that licensing examinations for upgrading licenses may require more extensive knowledge of some aspects of survival equipment operation or maintenance.

#### 5-4 SHIPBOARD TRAINING PROGRAMS AND RESPONSIBILITIES

##### a. Ships

Typically, U.S. merchant ships have no training program other than to meet the minimum regulatory requirement to hold one fire and boat drill each week. The master decides when fire and boat drills will be held and what additional training, if any, will be given. Typically, the chief mate supervises the fire and boat drill and may, in some cases, provide some type of demonstration of equipment or instruction at the drill.

Very few ships comply fully with the Coast Guard drill requirements to conduct drills as if an actual emergency exists and to break out and demonstrate use of all rescue and safety equipment. Some shipping companies require their

ships to hold periodic safety meetings, usually monthly, during which survival procedures and equipment may be discussed and, in some cases, demonstrated. Safety meetings are discussed at greater length in paragraph 5-7.

There are notable exceptions to the typical situation just described. A few shipping companies have very comprehensive shipboard safety training programs which cover all aspects of survival training. The various elements of these programs, such as required drills, demonstrations, safety meetings, safety inspections, bulletins and newsletters, films, etc., are described in subsequent paragraphs.

b. Drill Rigs

Training programs on board mobile and fixed platform drill rigs follow much the same pattern as those aboard ship, i.e., weekly fire and boat drills augmented in some of the larger companies by safety meetings. Training on drill rigs, particularly fixed platforms, is complicated by the absence of a well-defined organization and chain of command for emergency situations. Further complications are the large number of transient contractor personnel, usually half the personnel on the rig, and the lack of experienced seamen. A partial solution, adopted by some drill companies, is placement of a full time safety officer on the rig whose responsibilities include survival, firefighting, and first aid training.

c. Shore Management Responsibilities

Shipboard and drill rig survival training programs depend to a great extent upon the interest demonstrated by shore management. Some companies have staff engineers whose sole or major responsibility is safety. Safety engineers visit ships to provide instruction and encouragement. As previously mentioned,

some drilling companies now have full time safety officers on their rigs. In other, more typical companies, safety is a low priority collateral responsibility of the operations staff whose primary concern is to keep ships moving or drilling on schedule.

Unless it is provided by shore management, there is no motivation for ships' officers to do more than the minimum required training. In addition, very few officers have the necessary training or experience to be effective instructors. A frequently expressed attitude in both shore management and shipboard interviews was that safety training in general and survival training in particular was someone else's responsibility, e.g., the union or the Coast Guard.

#### 5-5 STATION BILLS

A basic beginning point for shipboard survival training is the ship's station bill which prescribes the stations and duties of crewmembers for fire and abandon ship emergencies. In accordance with U.S. Coast Guard regulations, 46 CFR 97.13, the bill must be prepared and signed by the master and posted in conspicuous locations, particularly the crew quarters, before the vessel sails. The duties, insofar as possible, are to be comparable with the regular work of the individual. The duties are to include the following and such others as are necessary in the case of the particular vessel for the proper handling of the particular emergency.

- (1) The closing of airports, watertight doors, scuppers, sanitary and other discharges which lead through the vessel's hull below the margin line, etc., the stopping of fans and ventilating systems, and the operation of all safety equipment.
- (2) The preparation and launching of lifeboats and liferafts.
- (3) The extinction of fire.

(4) The muster of passengers, if carried, which shall in general be assigned to the stewards department, and shall include the following:

- (i) Warning the passengers.
- (ii) Seeing that they are dressed and have put on their life preservers in a proper manner.
- (iii) Assembling the passengers and directing them to the appointed stations.
- (iv) Keeping order in the passageways and stairways and generally controlling the movement of the passengers.
- (v) Seeing that a supply of blankets is taken to the lifeboats.

(5) The custody of the portable radio apparatus.

Form CG 848 (Rev 7-67), Specimen of a Standard Station Bill, is provided to ships as a guide to preparation of station bills. The sample bill is prepared for a freight or tank ship with a crew of 58 persons.

Proposed SOLAS Chapter III requirements for station bills (called "muster lists") as set forth in the revised draft of Chapter III are essentially the same as U.S. regulatory requirements except for the following requirements which are not found in U.S. regulations:

- The muster list shall specify which officers are responsible for ensuring that each lifesaving and fire appliance is maintained in good condition and ready for immediate use.
- The muster list shall recognize that different situations may call for different actions and that key persons may become disabled.

Analyses of station bills such as the one shown in Figure 5-1 aboard seven different U.S. flag merchant vessels yielded the following findings concerning the adequacy of the typical merchant ship organization for dealing with emergencies.

# STATION BILL

MANNING	FIRE AND EMERGENCY STATION	ABANDON SHIP* STATION
Master	Bridge - in command	Same
First Mate	In Charge at scene	In charge fwd. lifeboat
Second Mate	Prepare lifeboats	In charge aft lifeboat
Third Mate	Bridge - assist	Same
Radio Officer	Radio - send distress msg.	Same
AB	Standby fwd	Assigned lifeboat
AB	Standby fwd	Assigned lifeboat
AB	Standby fwd	Assigned lifeboat
AB	Standby aft	Assigned lifeboat
AB	Standby aft	Assigned lifeboat
AB	Standby aft	Assigned lifeboat
OS	Standby aft	Assigned lifeboat
Chief Engineer	Engineroom - in charge	Same
First Asst.	Engineroom - throttle	Same
Second Asst.	Boilerroom	Same
Third Asst.	Engineroom - master steam smothering valve	Assigned lifeboat
Oiler	Engineroom - engine order telegraph	Same
Oiler	Engineroom - fire pump	Assigned lifeboat
Oiler	Engineroom - soot blowers & trim ventilators	Assigned lifeboat
Wiper	Engineroom - closes W/T doors and reports as messenger	Assigned lifeboat
Pumpman	On deck - stands by pumproom	Assigned lifeboat
Pumpman	On deck - stands by aft	Assigned lifeboat
Steward/Cook	Arouse, warn, & direct crewmembers and passengers	Same
Galleyman	Close all ports & doors port side aft	Assigned lifeboat
Messman	Close all ports & doors stbd. side aft	Assigned lifeboat
Messman	Close all ports & doors amidships	Assigned lifeboat

\* Boat stations are assigned according to berthing assignments.

Figure 5-1. Station Assignments Extracted from Typical Station Bill

(1) Fire and Emergency Stations. Typically, no one is designated to render first aid or provide a stretcher. Emergency squads are usually made up totally or almost totally of deck personnel. Such squads would be at a distinct disadvantage in fighting fires in engineering spaces<sup>1</sup>. No backup personnel are provided to relieve or substitute for emergency squad members. Often no one is designated to operate the fixed CO<sub>2</sub> fire extinguishing system. The engineroom and galley/living quarters are overmanned at the expense of backup personnel for the emergency squad.

(2) Abandon Ship Stations. In general, the option of using liferafts to abandon ship is overlooked in station bills. Usually no one is assigned to launch the liferafts and in no station bill examined were the crewmembers assigned to liferafts as alternates to lifeboats. Backup personnel for critical stations or equipment such as the portable radio and operating the lifeboat engine are usually not designated. First aid personnel for each boat or raft are not designated.

(3) Man Overboard and Rescue Stations. The station bills do not normally include stations for man overboard and rescue emergencies. Designation of personnel to launch and man a rescue boat, prepare to render first aid or resuscitation, to rig boarding ladders and cargo nets, to act as rescue swimmers, etc., would significantly improve readiness to act in such emergencies.

As indicated in the SHELL PLATFORM A casualty report and drill rig visits, station bills on drill rigs do not always clearly spell out chain of command responsibilities or the specific duties and emergency equipment assignments of individuals.

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<sup>1</sup>During a ship visit to obtain data for this study, a deck officer attempted to lead the visitor to the engineroom. After several unsuccessful attempts he was forced to ask an engineer to show him the way.

## 5-6 FIRE AND BOAT DRILLS

The principal and, in most cases, only method of conducting shipboard survival and emergency training is by means of the weekly fire and boat drill required by U.S. Coast Guard regulations. The consensus of most persons interviewed, both shipboard and shore, is that the typical fire and boat drill is such a perfunctory procedure that it has only minimal training value. Typically the day and time of the drill is known or announced in advance, the same procedures and same equipment are used at each drill, little or no instructions or demonstrations of equipment are provided, emergency situations are not simulated, and the duration of the drill is brief, typically 20 minutes. The following is a description of observed fire and boat drill procedures aboard an actual ship (from Merchant Marine Shipboard Crew Skills and Disciplines Study, Evaluation of Phase 1 Findings and Recommendations-R0-R0/L0-L0 MA-RD-900-72027-7):

"The customary procedures at fire and boat (abandon ship) drills are as follows. An announcement is made and a notice posted in the messrooms on the day of the drill as to the time the drill will be held. Fire drill is held first. At the signal, six seamen (members of the emergency squad) and the chief mate proceed to the stern where they break out and connect two fire hoses, spray water over the stern, and then stow them away. The same two hoses are used at each drill. On the bridge, the master operates the control to close and open the watertight door between the main and auxiliary engine rooms. The first assistant and electrician proceed to the emergency generator room where the first assistant starts the emergency diesel and runs it for a few minutes. With the exception of the DEMAC designated to stand by as messenger in the CO<sub>2</sub> room

and the three seamen designated to be on the bridge, other personnel do not go to their emergency stations or break out emergency gear. Even though the abandon ship signal has not yet been sounded, most personnel proceed to their lifeboat stations (see Figure 5-2).

When the hoses on the stern have been stowed away, the master sounds the abandon ship signal and remaining personnel, with the exception of the watch in the engineroom and bridge personnel, proceed to their assigned lifeboats. One boat, alternated at each drill, is lowered to the embarkation level. If it is the diesel-propelled boat, the engine is started and tested by the chief engineer assisted by a wiper. The boat is then raised to the stowed position and secured. When the bridge is notified that the boat is secured, the drill is

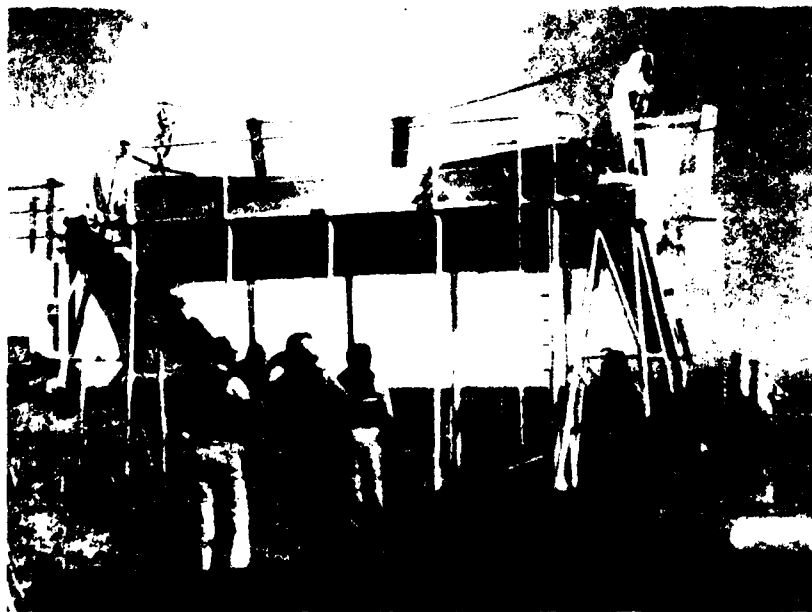


Figure 5-2. Crewmen Standing By for Abandon Ship Drill



terminated by sounding three short blasts on the whistle and three short rings on the general alarm. Total length of drills is about 20 minutes. No instructions or training in emergency procedures or equipment other than those described are given."

The following observations on fire and boat drills were provided by shipping company management officials during interviews:

"The fire and boat drill as it presently exists is really a perfunctory activity which is boring and creates a false sense of security. First, it usually only deals with one or two items of emergency equipment. Typically, the men simply report to their stations. In fire drills the men report to the same station every time--unreel the same fire hose, turn on the fire pump and squirt some water over the side (see Figure 5-3). The master on the bridge and some other officers might (and only might) witness the activities to see that it appears something is happening. It is highly unlikely that such a drill would be useful unless the fire is somewhere in the vicinity of where the drill always occurs. In addition, there is no cross training and therefore, each man only knows his muster point and his one responsibility. If men were injured or needed to be relieved for a breather, there would be no one trained to take their place. In addition, the men often have no idea where the fire stations are in the rest of the ship. Typically, the fire drill is followed by a boat drill which usually is no more than a muster at the lifeboats. In a slightly more advanced drill, they might lower a lifeboat to the rail and start the engine. There is seldom if ever any discussion of lifeboat operation."

"The present fire and boat drills are usually ineffective and repetitious. Often, the only people who come are those who are supposed to be working. They make a joke out of it by asking questions to prolong the drill and keep from having to go back to work. At each drill they pull the same hose out at the same spot which really has little to do with preparation for fire-fighting. The boat drill is often nothing more than a muster at stations."

"On one occasion, I blew the whistle signal for abandon ship and the men got the fire hoses out and squirted water over the side - just out of habit."

So far as could be determined, shipboard liferaft drills or training are virtually non-existent. The safety director of one company interviewed stated that the company believes it is important to provide liferaft training and does

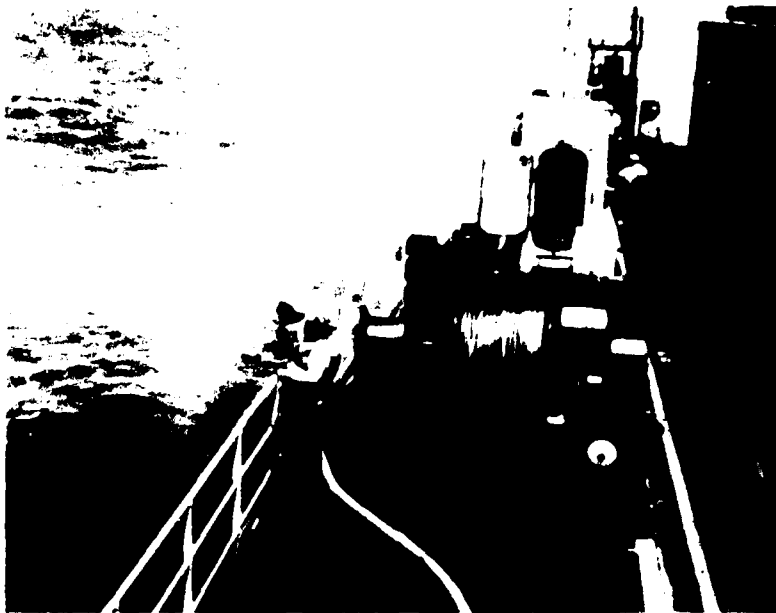


Figure 5-3. Typical Fire and Emergency Drill

so. However, during a visit aboard one of the company's ships it was reported that no liferaft training is given. Throughout the many interviews of industry personnel, review of reports, and ship visits, only two instances of realistic liferaft training were discovered. According to a Great Lakes shipping company official, his company requires a realistic in-water liferaft drill once each season, usually in September. The men don lifejackets or exposure suits, launch the raft, get into the water, board the raft, inflate the floor, and maneuver the raft. They also practice righting an overturned liferaft. A tanker company safety bulletin contained a brief story and photographs (Figure 5-4) of a liferaft demonstration aboard one of their ships. A liferaft due for annual servicing was inflated on deck to give crewmen a first-hand look at an inflated raft and its gear.



Nothing up my sleeve . . .



One quick heave on the lanyard . . .



. . . and there she grows!



Almost ready for immediate occupancy . . .



With a front and back door



And this is the main cabin . . .

Figure 4 - Inflatable Demonstration. Always Eject from Company Safety Equipment.

Some of the reasons given by shipboard personnel for not conducting more realistic drills were: masters don't believe drills are important, most officers don't have any interest in training, there is not enough time, and it is dangerous to inject more realism such as conducting a drill at night, putting a boat in the water, or setting off a smoke pot. Another reason given was that the union contract requires that drills be held during regular working hours and that any more extensive drills would involve payment of overtime.

There are, in a few U.S. shipping companies and on an occasional ship, notable exceptions to the typical fire and boat drill routine. One shipping company requires the following drills or training in addition to the weekly fire and boat drill: (1) damage control instruction once a month, (2) lifeboat radio instruction once every 3 months, (3) man overboard drill (Williamson turn) once every 3 months. Other requirements are that at least three drills each month include a simulated fire. Other drills must simulate various emergency situations such as evacuation of injured personnel, use of breathing apparatus in firefighting, rescue from enclosed spaces, and bypassing damaged sections of the fire main. Completion of required drills, demonstrations, tests, and inspections must be recorded on a checkoff form which is retained on board permanently.

In another company, one of the ship's officers, designated the safety officer, gives 30 to 60 minutes of instruction at each fire and boat drill (see Figure 5-5). When it is time to send CO<sub>2</sub> cylinders ashore for inspection, several are discharged at fire drills. Training is provided on the best way to jump into the water from the deck with a lifejacket on. A safety bulletin from a tanker company reported a captain who, when it came time to renew the foam chemical, held a fire drill and had the emergency squad coat the deck with foam.



Figure 5-5. Chief Mate Instructing Emergency Squad  
in Use of Flame Safety Lamp

Fire and boat drills on drilling rigs follow the same general pattern as a typical drill on a merchant ship with the added confusion created by a large number of transient contractor personnel who must be treated essentially as passengers.

#### 5-7 U.S. COAST GUARD INSPECTIONS OF FIRE AND BOAT DRILLS

During the course of annual and biennial inspections, Coast Guard inspectors require ships to conduct fire and boat drills. If the drill is not conducted satisfactorily, the inspector may require the ship to repeat it, although this is seldom done. In conjunction with the Great Lakes Ship Riding Program, Coast Guard inspectors observe emergency drills while the ship is underway.

Observation of an actual Coast Guard inspection of a fire and boat drill indicated that such drills are conducted in the same perfunctory manner as a typical drill at sea.

#### 5-8 SAFETY MEETINGS

The next most prevalent method of shipboard training to fire and boat drills is safety meetings. Of twelve shipping companies and two drilling companies interviewed, six reported that safety meetings were conducted on their ships or rigs. Typically, safety meetings are held once a month. Usually, on ships, separate safety meetings are held at the department level and at the master's level. Department level meetings usually include all unlicensed personnel. Master's level meetings include all officers and senior unlicensed personnel. Some companies provide an agenda for the meetings through the medium of a safety bulletin. In other companies, the topics for the meeting must be planned by the ship's officers. Generally the meetings are concerned with safety hazards, safety precautions, reviews of accidents, and instruction on lifesaving, firefighting and safety equipment. Usually, minutes or reports of the meetings must be submitted to shore management. In some companies, good ideas generated at meetings are circulated to all ships of the company's fleet in a safety newsletter.

Companies who require safety meetings consider them to be very effective in promoting shipboard safety consciousness and reducing accidents.

#### 5-9 OTHER TYPES OF SHIPBOARD TRAINING

Shipboard training may also be conducted by non-shipboard personnel such as company safety engineers, survival equipment manufacturers' representatives, and private firms specializing in marine safety or firefighting training. Each of these types of "outsider" training is briefly discussed in the following paragraphs.

a. Safety Engineers

Three of the twelve shipping companies interviewed used staff safety engineers to monitor, aid, and conduct shipboard safety training. Two were tanker companies, the third was an LNG company. In general, the procedures were much the same in each company. A safety engineer visits each company ship periodically, at least once a year, holds emergency drills, provides instruction in various types of safety and survival equipment, shows training films or slide shows, discusses safety problems, and provides training materials such as posters, pamphlets, and films. In one company, a safety engineer goes aboard each ship once every nine months and rides the ship for approximately one week.

Two liner companies commented that problems may arise which tend to reduce the effectiveness of safety engineers in conducting safety training programs. These problems result from the fact that company safety officials may be overzealous in investigating accidents from a claims-oriented rather than a safety-oriented point of view.

One of the two drilling companies visited had full-time safety officials on their rigs. Called Industrial Relations Representatives, these individuals are primarily concerned with industrial safety, but also conduct survival and firefighting training at weekly fire and boat drills and include survival and firefighting instruction in the safety meetings they conduct. The other drilling company said that it is seriously considering placing safety/training officers on its rigs.

b. Manufacturer Training

In the survey of survival equipment manufacturers it was found that a number of manufacturers, particularly producers of lifeboats, survival capsules, exposure suits, and firefighting equipment, offer training to shipboard

personnel in the form of instruction, demonstrations, and films covering operation and use of their equipment. During a shipboard visit, a deck officer commented that the best training he had received was from equipment manufacturers while they were aboard to inspect their equipment and provide instruction in its operation.

c. Private Marine Training Firms

During the course of the study, three private firms were identified who specialize in providing shipboard safety training and training materials. One firm provides shipboard training in firefighting and first aid. The other two firms conduct general safety training including use of survival equipment, however, their services are primarily used by foreign-flag shipping companies.

5-10 TRAINING MATERIALS

With the exception of the training materials provided by a few tanker companies to their ships, there is a serious shortage of good survival and firefighting training materials for shipboard use. Judging from ship visits and interviews, the only survival training material likely to be found aboard the typical U.S. merchant vessel may be the Proceedings of the Marine Safety Council, which is generally not made available to the entire crew. A survey of crewmembers on four ships indicated that no training films or slides were shown and no training materials were distributed or made available. The only training material observed on any of the ships visited were some posters on one ship covering wearing life preservers, resuscitation procedures, and uses of different types of portable fire extinguishers. Two ships had tape players for their television sets which could be used to show training films, but were not.



The following paragraphs describe the various types of survival training materials that are available or provided by individual shipping companies or private firms. It should be understood that the majority of these are found or used aboard only a relatively small percentage of U.S. merchant ships.

a. U.S. Coast Guard Publications

The U.S. Coast Guard publication, Proceedings of the Marine Safety Council, is published monthly and is found aboard most U.S. merchant ships. It contains many excellent articles relating to survival and firefighting, however, it is written at the college level and is primarily oriented towards licensed personnel and safety officials. Two other Coast Guard publications are the Manual for Lifeboatmen, Able Seamen, and Qualified Members of Engine Department CG-175 and the Fire Fighting Manual for Tank Vessels CG-329. These publications do not include operation of more recent survival equipment such as survival capsules, enclosed lifeboats, and smoke detection equipment. Information on launching and operation of liferafts is very limited and does not include a discussion of survival techniques. According to Harry Lundeborg school instructors, Coast Guard manuals are not very useful to the average seaman because they are written too far above his reading level which is approximately 7th to 8th grade.

b. Maritime Administration Publications

The Maritime Administration has developed a comprehensive manual on shipboard firefighting which will be made available to maritime training institutions and ships when published. However, according to school instructors who have reviewed the manual, it is too voluminous (500 pages) and written at too high a reading level to be directly useful as shipboard training material. Presently under consideration by MarAd is development of training materials for survival-at-sea training which may include a manual.

c. Safety Bulletins and Newsletters

Safety bulletins or newsletters are perhaps the most widely used form of training material. A number of shipping companies, particularly tanker companies, publish their own bulletins or newsletters, usually on a monthly basis. Articles cover all types of safety matters including survival and firefighting. In addition to safety articles, company bulletins usually include recognition of ships with good safety records and individuals submitting good safety ideas. An example of a page from one of the better safety bulletins is shown in Figure 5-6. The National Safety Council publishes a Marine Newsletter which is subscribed to by most shipping companies. Safety newsletters for shipboard use are also produced by several private training firms.

d. Indoctrination Booklets and Manuals

On some ships, usually tankers, and drill rigs new men are provided with a small booklet or manual describing safety procedures and equipment, including survival equipment, aboard that particular ship or rig. In one tanker company, new men are furnished with a card containing a safety checkoff list. Each new man is given a tour by the ship's safety officer and instructed on the various items on the safety checkoff list by his supervisor. Samples of pages from a safety indoctrination booklet and a safety checkoff card are shown in Figures 5-7 and 5-8.

e. Audio-Visual Aids

Audio-visual aids on survival subjects, primarily motion pictures, are available from several sources but insofar as can be determined are rarely used in shipboard training. According to the Maritime Advisory Training Board, most of the films that are available are out-of-date. Recently, under the

# From the minutes...

**SS HOWARD G. VESPER** (Captain's Log)

The fire fighting foam squad in our foam system storage tanks was beginning to go off test. When the replacement supply of new foam liquid was received, we arranged to empty the tanks for cleaning and refilling by holding a foam fire drill. We manned 6 foam nozzles and monitors and in 10 minutes we emptied the main foam tank (1500 liters) and, as the photographs show, we covered the port side of the main deck with a full foam blanket.

We saved the secondary tank (200 liters) to hold another demonstration and drill for the new crew of boats coming aboard next week."

**Comments:** This was good training, it tested the system, drilled the crew, and made profitable use of material marked for discard -- and the foam is good fish food, and fully biodegradable too!

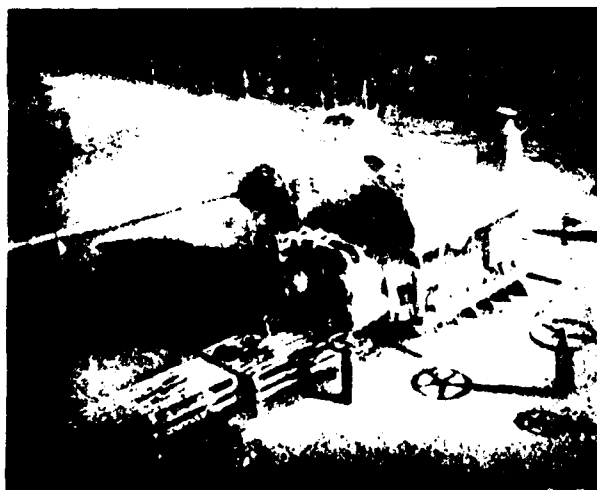


Figure 5-6. Sample Page from a Company Safety Bulletin

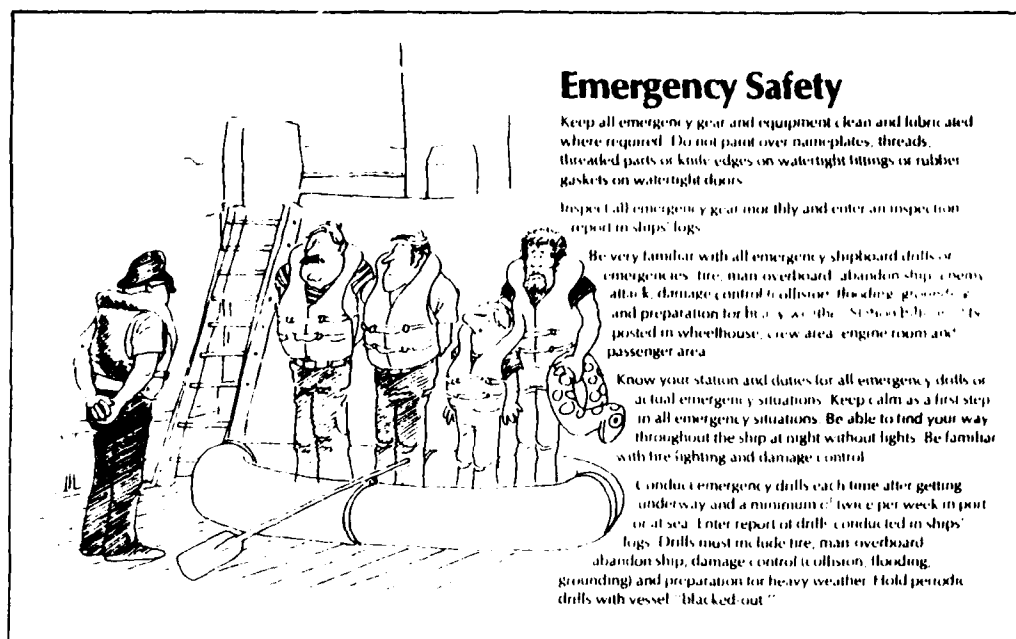


Figure 5-7. Sample Page from Safety Indoctrination Booklet

	<p><b>GENERAL SAFETY</b></p> <ul style="list-style-type: none"> <li>Smoking Regulations</li> <li>Dangers of Enclosed Spaces</li> <li>Mooring/Unmooring</li> <li>Handling Lines</li> <li>Operating Machinery</li> <li>Cargo Booms, Storing — Suspended Loads</li> <li>Boarding Seas — Bad Weather</li> <li>Gas Hazards</li> <li>Helicopter Operations</li> <li>Proper Use, Stowage and Care of Tools, Equipment and Stores</li> <li>General Housekeeping</li> <li>Lifting/Carrying</li> <li>Sanitation/Health</li> <li>Proper Use of Ladders/Gangway</li> <li>Watertight Doors/Portholes — Deadlights</li> <li>Caution in Moving About the Decks</li> <li>Reporting Injury/Illness</li> </ul>	<p><b>SAFETY EQUIPMENT</b></p> <ul style="list-style-type: none"> <li>Breathing Apparatus</li> <li>Safety Belts</li> <li>Eye Protection: <ul style="list-style-type: none"> <li>Goggles (Chipping/Chemical)</li> <li>Glasses</li> <li>Face Shield</li> </ul> </li> <li>Hard Hats</li> <li>Shoes/Gloves</li> <li>Bomber Suits</li> </ul> <p><b>DRILLS</b></p> <ul style="list-style-type: none"> <li>Station BIR, Bunkcard, Alarm Signals</li> <li>Fire and Emergency Drills</li> <li>Life Jackets</li> <li>Fire Fighting Equipment: <ul style="list-style-type: none"> <li>Deck</li> <li>Engine and Living Spaces</li> </ul> </li> <li>Man Overboard</li> <li>Abandon Ship</li> <li>Life Boats — Launching and Equipment</li> <li>Life Rafts</li> <li>Tank and Pumproom Rescue</li> </ul>
	<p>SAFETY CHECK-OFF CARD</p>	

sponsorship of the Maritime Advisory Training Board, the National Maritime Union produced an award-winning film on shipboard firefighting. Entitled "What We Owe Each Other," this film is the first in a planned series of 12 films on shipboard firefighting and provides an overview of firefighting and motivation to learn more about it. Ultimately, the MATB plans to develop a library of training films which will be available for purchase by shipping companies. One tanker company reported that they purchase films and filmstrips for their ships from several foreign producers covering firefighting, abandon ship, resuscitation, first aid, survival at sea, and liferafts. An LNG company has produced six training films which include training in lifeboats, firefighting and damage control for LNG crews. It was also reported that IMCO has a library of films which includes the following titles: "Launching a Lifeboat," "Helicopter Rescue at Sea," and "Fighting Fires Aboard Ship." Films or slide shows suitable for training purposes are also available from some manufacturers of survival capsules, exposure suits, and firefighting equipment.

A majority of the shipping company safety and training officials interviewed advocated the use of audio-visual aids for shipboard survival training, but claimed they would be too expensive for one company to produce or even to purchase. NOTE: The cost of the first film in the MATB series of 12 on firefighting is \$125.

#### 5-11 OPERATOR-PROVIDED SHORE TRAINING

##### a. Firefighting Training

Shore firefighting schools provide the only really effective means of training seamen to fight fires and instilling in them the confidence that they can cope with even very large fires on board ship.

The Maritime Administration currently supports two firefighting schools in cooperation with the Military Sealift Command. One school is located at Earle, New Jersey, the other at Treasure Island, San Francisco, California. In fiscal 1979, 3830 students attended the two schools, 471 at Treasure Island and 3359 at Earle, New Jersey. MarAd provides instructor and financial support to both schools. Expansion plans include two more facilities; one at Toledo, Ohio and the other at New Orleans, Louisiana. This expansion is designed to meet the requirements of the new tankerman regulation which requires all tankermen to attend firefighting school. Firefighting students come principally from the maritime academies, union schools, and tanker companies with independent unions.

Another excellent firefighting school is the Texas A & M, Fire Protection Division, Marine Fire Fighting Program at College Station, Texas. This school conducts the following courses:

- Marine Firefighting and Emergency Training (continuous course accommodates 30 students)
- LNG Training
- El Paso LNG Crew Training

Students come primarily from tanker companies with independent unions and LNG companies. Foreign students are also trained.

b. Shore Training for Drill Rig Personnel

A drilling company reported that they provide shore training in industrial safety and first aid for the Industrial Relations Representatives who serve as full-time safety officers aboard the rigs.

A number of drilling companies in the Gulf area send drill rig personnel to private schools which provide them with instruction and training needed to obtain a lifeboatman certificate. This is done in order to comply with Coast Guard requirements for three lifeboatman on most drill rigs.

#### 5-12 EMERGENCY SITUATION DECISION MAKING AND LEADERSHIP TRAINING

The casualty reports of the SS SMITH VOYAGER and SS PANOCCEANIC FAITH clearly point to lack of leadership and failure to make correct command decisions in emergency situations as the primary causes for loss of ships and lives in these and other maritime disasters. In interviews, shipping operators, safety officials, ships' officers, maritime training school directors, union officials, and Coast Guard officers were unanimous in their opinion that masters and ships' officers were inadequately trained with respect to their responsibilities to exercise leadership and make correct command decisions in emergency situations. Numerous examples were cited to support this view: refusal to acknowledge that disaster conditions exist until the situation is out of hand; inability to correctly interpret available information to identify the real problem; failure to plan actions ahead of time; panic and failure to take charge; fighting the smoke instead of the fire; no one leading the firefighting party; and simply failing to sound an alarm.

Recommendations to remedy this situation include refresher training for officers in emergency situation decision making, use of simulated emergencies which would require interpretation of information and command decisions, and requiring masters, emergency team leaders and lifeboat commanders to become actively involved in realistic emergency drills.

## 5-13 EDUCATIONAL AND PSYCHOLOGICAL ASPECTS

### a. Reading Levels and Language Problems

According to tests conducted by the Harry Lundeberg school, the average reading level of entry level seamen is 7th to 8th grade. In interviews of industry and training personnel, there was considerable difference of opinion as to the reading ability and interest of seamen. One school of thought is that seamen are poor readers and therefore will not benefit from written training materials. The opposite view is that seamen, because of the many hours of spare time and lack of anything else to do, are avid readers and will absorb something of value from training material provided it is written at their reading level, particularly if it is accompanied by illustrations.

Another educational problem in shipboard training arises from the fact that a small but significant minority of seamen speak and understand very little English. This is further compounded by the fact that few officers are trained or experienced as instructors and therefore are unable to adjust their instructions to the trainees' level of understanding.

### b. Attitudes Toward Survival and Emergency Training

Years of exposure to standard shipboard fire and boat drills have bred an indifference to survival and emergency training on the part of the typical American seaman. Only in ships where the hazard is more immediately apparent such as oil tankers and LNGs and where vigorous company-sponsored training programs are in effect is this indifference overcome. Other attitudes which inhibit training were reported to be: complacency, i.e., "nothing will happen to me or to this big ship," and resignation, i.e., "you can't beat the sea" or "if it goes (LNG) you go with it." On the typical U.S. merchant ship



with rapid crew turnover, there is no feeling of "this is my ship" and "these are my shipmates." As a result it is very difficult to attain the degree of teamwork which is essential to effective action in emergency and survival situations.

As previously stated, shore management attitudes toward training have an important bearing on the effectiveness of shipboard training. A fairly common attitude expressed in interviews was that because of the lack of permanence in crews, there is really very little the company can do to improve the state of training and that it should be the union's responsibility to provide men who have adequate emergency and survival training.

Another attitudinal difficulty is the animosity which sometimes arises between merchant marine and Coast Guard personnel. Because many Coast Guard inspectors are young and sea-inexperienced, they are not considered qualified to perform their jobs by merchant marine personnel. Coast Guard requirements for drills, tests, inspections, etc., tend to be regarded as necessary evils which must be performed, but with the least effort sufficient to satisfy the Coast Guard.

c. Effective Approaches to Emergency/Survival Training

Research by educational specialists in the field of safety training indicates the following approaches are the most effective in overcoming negative attitudes toward safety training:

- Use of a positive approach. Scare tactics do not work. Over-emphasis on the consequences of unsafe acts tends to create anxiety which is dealt with by blocking out the anxiety-creating situation and, along with it, the training.
- Active support and encouragement by shore management is essential to effective shipboard training programs.

- Training materials should be brief and to the point, written at the seaman's reading level and designed to capture his interest through the use of illustrations. However, use of "sexist" material or the comic book approach has not been found to be effective.
- Audio-visual training aids are most effective when used as preparatory instruction to practical, "hands-on" training.
- The most effective type of training for shipboard personnel is through actual operation of the equipment in simulated emergency conditions. This requires advance planning and imagination, preliminary preparation of the trainees, actual operation of equipment insofar as possible, and post-training critique. As the state of training progresses, surprise drills, smoke pots, nighttime drills, blacked-out drills, and other measures should be used to increase realism and instill confidence and teamwork. Leaders, i.e., Master, Chief Engineer, Mates, etc., as well as followers, should participate.

#### 5-14 SUMMARY OF TRAINING PROBLEMS AND DEFICIENCIES

The principal underlying problems in shipboard emergency and survival training are rapid personnel turnover, the requirement to pay overtime for any training other than the weekly fire and boat drill, the greatly increased tempo of operations, and the lack of any motivating factors to perform any training beyond the minimum Coast Guard requirements or to improve the quality of training. Of all these problems, rapid personnel turnover is the biggest, and least susceptible to solution. Lack of permanence in the crewmembers frustrates

efforts to instill a sense of responsibility for ship or shipmates or to build teamwork which is so essential to successful counter action in an emergency. Another effect is to eliminate any benefits an operator might otherwise derive from investing time and money in additional or improved training. The requirements of typical union contracts are such that overtime must be paid for any training other than that conducted at the standard fire and boat drill. Contract provisions virtually eliminate the possibility of more realistic drills such as surprise drills or nighttime drills. The greatly increased tempo of operations mitigates against lowering and exercising the boats in the water or stopping to hold a man overboard drill. Finally, the lack of interest and support from shore management, with rare exceptions, and the absence of any rewards for effective shipboard emergency and survival training eliminate any motivation other than Coast Guard regulations.

Drilling rigs, particularly stationary rigs, have additional problems created by the lack of a well-defined organization and chain of command and a large number of transient personnel who for emergency or survival purposes must be considered as passengers.

The survey of shipboard emergency and survival training practices reveals the following major deficiencies:

- Lack of a single central authority for the training of merchant marine personnel. This can lead to significant differences in the skills or skill levels of seamen depending on the training program they are a product of.
- Many entry level seamen who are untrained in survival or fire-fighting before going to sea. It is quite possible for a seaman to go through an entire seagoing career without ever receiving such training.

- Station bills which do not provide adequate organization or assignments for emergencies. Principal shortcomings are lack of liferaft assignments including leaders; lack of backup emergency squads and absence of engineering personnel in squads; lack of first aid assignments; lack of man overboard and rescue station assignments; and on drill rigs, lack of a clear-cut chain of command and assignment of specific duties.
- Minimal compliance with Coast Guard regulations for fire and boat drills by most ships. Typically, drills are performed by rote, emergency equipment is not used or demonstrated, emergency situations are not simulated, emergency squads are not trained as teams and, as a result of the lack of any realism, the drills are of little value in preparing the crew for emergencies.
- An unvarying sequence (fire followed by abandon ship) and pattern (all but a few hands proceed directly to boat stations upon hearing emergency alarm) which breeds a conditioned response to abandon ship rather than to cope with an emergency. Reports of several marine casualties seem to bear this out. At the very least, this practice results in only a small percentage of a ship's total manpower being available to deal with the emergency.
- No training in liferaft launching, boarding, operation, or survival techniques.
- Relatively limited use of such valuable adjuncts to drills as safety meetings, visits and training by safety engineers, manufacturer and private safety firm training.
- Lack of good survival and firefighting training materials, i.e., posters, pamphlets, films for shipboard use and very limited distribution and use of materials that are available.
- Out-of-date training materials and training materials which are written at too high a reading level for the average seaman.
- Insufficient numbers of maritime personnel trained at shore firefighting schools. However, this deficiency is gradually being corrected as additional MarAd schools are opened.
- Lack of training for officers in leadership and decision making in emergency and survival situations and failure of masters, emergency team leaders, and lifeboat commanders to become actively involved in realistic emergency drills.

## SECTION 6

### ANALYSIS

#### 6-1 INTRODUCTION

The objective of the analysis was to develop recommended approaches which the Coast Guard could take in establishing requirements for shipboard survival equipment operating instructions and information, maintenance information and performance, and training. In accordance with the requirements in the Coast Guard Statement of Work, the primary concern was with on-board training and drills and operator-provided shore training for specific survival equipment. However, during the course of the background study a number of recommendations were received which, although concerned with pre-sea and other shore training, would have a direct impact on shipboard training; therefore, such recommendations were also considered in the analysis.

The basic methodology used in the analysis was as follows:

1. The deficiencies identified in each study area, i.e., operation information, maintenance information and performance, and training, were compared with existing requirements to identify the need for changes or additional requirements or other measures to satisfy the need. Proposed SOLAS Chapter III requirements were included in the comparison in order to assist the Coast Guard in making decisions on implementation of the requirements or recommended changes or additions to them.

2. All the recommended approaches and specific recommendations applicable to each area were listed. These included recommendations from marine casualty reports; other studies; interviews of shipping company, union, shipboard, maritime school, Coast Guard, Maritime Administration, and other industry and government personnel; and recommendations developed by study group personnel.

3. Recommendations were examined against assumptions and criteria of economic, practical, and regulatory feasibility.

4. The most feasible approaches and recommendations were selected.

#### 6-2 ASSUMPTIONS AND CRITERIA

The following assumptions were established to define and delimit the scope of approaches and recommendations:

- Rapid turnover of crew will not change.
- Union contract requirements with respect to payment of overtime for training other than that performed at fire and boat drill will remain essentially unchanged.
- The current high tempo of operations and competitive pressures will continue to make it unfeasible to interfere with or delay ships' operations solely for training purposes.
- The present organization and manning of ships will remain essentially the same.

The following criteria were used to evaluate alternative approaches and recommendations:

- Economic feasibility. Consider cost of requirement to operator, government, and equipment manufacturer.
- Acceptability. Consider acceptability to shipboard personnel, to unions, to operators, and to manufacturers of survival equipment.
- Regulatory feasibility. Consider enforceability of requirement.
- Practicality. Consider practicality in terms of existing shipboard time, facilities, and personnel available for training and maintenance.

### 6-3 OPERATING INSTRUCTIONS AND INFORMATION

The principal areas of deficiencies in survival equipment operating instructions and information are in connection with availability, location, readability, and understanding. The analysis of each of these is discussed in the following paragraphs:

#### a. Availability

Posted operating instructions are not available for many items of survival equipment including lifeboat launching equipment, lifeboat engines, portable fire extinguishers, and fire main stations. In addition, posted instructions are not available for such important survival procedures as the proper way to wear life preservers, proper way to jump into water from a height, how to minimize hypothermia, and survival techniques in a lifeboat. While there are no regulatory requirements for instructions for the equipment mentioned, there are requirements for other comparable equipment such as the requirement for not one, but two types of posted instructions for launching inflatable liferafts.

#### b. Location

Posted instructions are not always located where they will be immediately available to persons operating the equipment. Whereas there are specific location requirements for some equipment such as liferafts, fixed CO<sub>2</sub> systems and portable radios, there are no requirements with respect to other survival equipment.

#### c. Readability

Some posted operating instructions are difficult or impossible to read because of size of print, lettering background, poor placement, weathering, or

available lighting. Some existing equipment specifications go so far as to specify the size of the lettering or their color whereas others are silent on the subject. IMCO SOLAS proposed requirements state that posters and signs must be easily readable under emergency lighting conditions.

d. Understanding

Instructions for some types of survival equipment such as fixed CO<sub>2</sub> systems, survival capsules, and portable radios are not sufficiently simple and clear for inexperienced crewmen to quickly grasp under the stress of emergency conditions. Illustrations, diagrams, arrows, color coding, and other graphic aids to understanding and to gaining attention are seldom used. While equipment specifications sometimes contain requirements for simplicity and clarity of instructions, they are not uniform or definitive. In particular there are no requirements as to reading level, use of illustrations, or use of designs to attract interest.

e. Recommended Approach

The specifications and regulations for all types of survival equipment and survival procedures should be reviewed and revised to establish uniform, definitive requirements and standards for posted (or attached) operating instructions or information. The following specific recommendations should be considered:

- Posted (or attached) operating instructions or information should be required for every item of survival equipment and for certain important survival procedures such as donning a life preserver or exposure suit, jumping from a height with a life preserver on, helicopter rescue, minimizing hypothermia, and survival techniques in survival craft.



- Posted operating instructions for equipment should be located immediately and conveniently adjacent to the equipment to which they pertain.
- Survival procedure information posters should be located in places where they will be frequently read such as messrooms, staterooms, heads, and watch stations.
- Uniform requirements should be established for format, size, color, and background of lettering. Requirements should also be established for availability of emergency lighting where it would be needed such as in a CO<sub>2</sub> room.
- Requirements for understanding should cover style, reading level and use of illustrations where appropriate. Samples of acceptable operating instructions for each type of survival equipment should be prepared and made available to manufacturers of survival equipment.
- Coast Guard inspection guidance should include a requirement to inspect for adequacy of survival equipment operating instructions and survival procedures information.

With certain exceptions, it would be impractical and economically unacceptable to make such revised specifications retroactive to presently installed survival equipment. Therefore, it is recommended that the requirements only be applied to new equipment procurements after a certain date. In the meantime, the Coast Guard should make operators aware of the availability of operation information posters and placards which can be purchased at reasonable cost such as the following:

Liferaft Manual and Automatic Launching, Inflation, Boarding, and Parts. Available from SWITLIK Parachute Co., Inc. 14" x 20" cardboard poster \$4.00. Decals stating types of fires portable extinguishers should be used on. Available from Walter Kidde Co., Belleville, N. J. \$0.25 each.

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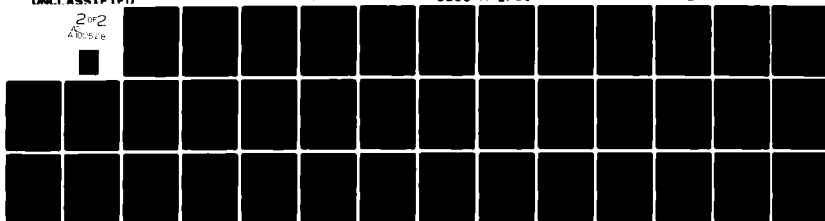
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- Coast Guard inspectors should be empowered to require replacement of any posted operating instructions which are unreadable, incorrect, inappropriately located, or very difficult to understand.
- An appropriate agency such as the Maritime Administration should be requested to develop and provide posters on survival procedures such as water entry from a height, hypothermia, helicopter rescue, and lifeboat survival techniques.

#### 6-4 MAINTENANCE INFORMATION AND PERFORMANCE

Maintenance manuals for survival equipment vary widely in quality and adequacy of information. Major deficiencies include poorly defined maintenance requirements, illegible drawings, and lack of a schedule of periodic maintenance requirements.

There are no specific regulatory requirements for maintenance manuals for survival equipment.

The draft revision of SOLAS Chapter III lays down specific requirements for maintenance manuals for survival equipment including a check list for carrying out monthly inspections, a schedule of periodic maintenance, and a lubrication diagram.

Only one of the ships and drill rigs visited had an adequate documented maintenance program for survival equipment (the MarAd Shipboard Maintenance and Repair System). Only one other ship kept any records of survival equipment maintenance other than required deck log entries. There are no regulations

which require ships to maintain maintenance schedules or records of maintenance performed on survival equipment other than the required deck log entries. These entries do not cover all survival equipment or even very important maintenance requirements such as the annual servicing of liferafts.

The need for better maintenance information and an organized maintenance program is substantiated by reports of casualties of lifeboat launching equipment and by the examples of corrosion and lack of lubrication observed aboard the ships visited.

Recommendations for improvements in survival equipment maintenance information and performance are:

- Revise specifications for survival equipment to include a requirement for a maintenance manual (if maintenance is required) with contents as prescribed by the proposed SOLAS regulation D VII/2.

In most cases, such a specification would only require a manufacturer to make minor improvements or additions to existing manuals. However, because of the additional expense, it is recommended that the requirement only be imposed for new equipment procurement.

- Require ships to have an approved, documented maintenance program for survival equipment which would include a schedule of the maintenance requirements (regulatory and manufacturer) for each equipment and a record of their accomplishment. A precedent for such a requirement is the requirement in NVIC 1-69 for an approved maintenance program for unattended engineering plants.

## 6-5 PRE-SEA TRAINING

While pre-sea training is not a primary concern of this study, the lack of any pre-sea survival training for many seamen directly affects shipboard training in that it means that fundamentals rather than advanced team training must be taught. There is no regulatory requirement that entry-level seamen in the U.S. Merchant Marine have such training. Resolution 19 of the IMCO Convention on Standards of Training, Certification, and Watchkeeping (see Appendix A for complete text) recommends that every prospective seafarer be given survival training before going to sea. It is proposed that the Coast Guard adopt this recommendation as a mandatory requirement for U.S. seamen. The training could be provided at union schools as is now done by the SIU at the Harry Lundeberg school or could be provided in conjunction with firefighting courses at MarAd-sponsored firefighting schools. Because of the expense involved and the possibility that some trainees would not continue a maritime career, it is suggested that training for entry-level personnel be limited to a one or two-day course. More extensive survival training should be deferred until the individual is ready for upgrading.

## 6-6 TRAINING PROGRAMS AND RESPONSIBILITIES

Most merchant ships have no survival training program and no well-defined responsibilities for carrying out ship's training. There are no regulatory requirements in this respect other than that the master conduct weekly fire and boat drills and ensure that all hands are familiar with their emergency duties. It is proposed that the Coast Guard in conjunction with the Maritime Administration and the Maritime Advisory Training Board develop a "Shipboard Survival Training Guide." This guide would provide a recommended program of

drills, exercises, demonstrations, instructions, etc., for shipboard use. It would also suggest assignments of training responsibilities to officers. In addition it would contain suggestions and scenarios for conducting drills to achieve greater realism. This aspect of the guide is covered in greater detail in paragraph 6-8. The guide would be distributed to all U.S. flag ships and would also be used by Coast Guard inspectors as a basis for judging performance of drills at annual and biennial inspections. The cost of such a guide would be minimal in comparison to its potential benefits. While all ships might not follow or only partially follow the recommended program, it would provide a beginning for many who have no program and no idea of what to do. It would help to standardize shipboard training throughout the industry and many shipping companies might be persuaded to require their ships to follow the programs outlined in the guide.

#### 6-7 STATION BILLS

Shipboard survival training is based on the organization and duties assigned in the ship's station bill. If the organization is inadequate or the duties not appropriately conceived or assigned, the training will not be adequate to meet the emergency. Typical ships station bills fail to make the best use of available personnel or equipment, for example, emergency squads composed almost totally of deck personnel and no assignments of personnel to liferafts. Despite these and other inadequacies, the bills satisfy current Coast Guard regulatory requirements. They do not, however, meet the proposed SOLAS requirement that the bill recognize that different situations may call for different actions and that key persons may become disabled. It is recommended the Coast Guard station

bill requirements in 46 CFR 97.13 be revised to require more adequate organization and assignment of personnel to meet all types of emergencies including man overboard and rescue of survivors. The revision of the requirements should include consideration of the following:

- Inclusion of the proposed SOLAS requirements for "muster lists."
- A requirement that composition of emergency teams be divided between deck and engine personnel and that backup teams and team leaders be designated.
- A requirement that personnel should have both lifeboat and liferaft abandon ship stations.

In conjunction with the revision of the requirements, Coast Guard form CG 948 (Rev 7-67), Specimen of a Standard Station Bill, should also be reviewed and revised to show sample stations and assignments in keeping with the revised requirements. Several specimen bills should be prepared for different types of ships with present-day manning scales.

#### 6-8 FIRE AND BOAT DRILLS

The principal deficiencies in fire and boat drills can be summarized as follows:

- Drills announced in advance and conducted by rote. Fire and emergency drill always first and always followed by abandon ship drill. Few crewmen participate in the fire and emergency drill.
- All emergency gear not broken out and demonstrated as required by Coast Guard regulations.
- Realistic emergency situations not simulated. Emergency squads not trained as teams.
- Liferaft training rarely conducted. Liferafts almost never inflated for demonstration.

U.S. Coast Guard regulations require that a fire and boat drill be conducted at least once a week, that it be conducted as if an actual emergency existed, and that all rescue and safety equipment be broken out and demonstrated by persons designated to use them. Most ships comply with the first requirement, few comply fully with the others. Coast Guard regulations do not require liferaft training at fire and boat drills. Proposed SOLAS drill requirements differ from U.S. requirements in the following respects: There is no requirement for a weekly drill, rather the requirement is that each member of the crew must participate in at least one drill each month. Presumably this could be accomplished with two drills per month. There is no requirement, as there is in U.S. regulations, that fire drills and boat drills be held at the same time. The requirement for launching and operating lifeboats in the water is once every two months, if possible, as compared to once every three months as in U.S. regulations. The SOLAS requirements do not include any requirement for liferaft training or demonstrations.

The weekly fire and boat drill has become so ingrained in U.S. merchant ship routine that it is difficult to imagine that any other type of training would find acceptance. Therefore, the recommended approach is to concentrate efforts on making the weekly drill as effective as possible. Three avenues of approach are recommended, one through revision of regulations, one through providing ships with guidance for conducting more realistic drills, and one through conducting more rigorous inspections of drills. The first two approaches are discussed in this paragraph, the third is discussed in paragraph 6-9.

The current regulations for fire and boat drills should be reviewed and revised with the objective of permitting and promoting more realistic drills. The following suggestions are offered to achieve this objective:



- Do away with the term, "fire and boat drill." This term has the unfortunate connotation that a fire is always followed by abandonment of the ship and the only way to abandon ship is via lifeboat. Instead, use a collective term such as "emergency drills" or "survival drills" which would encompass all emergencies, i.e., fire, flooding, man overboard, rescue, and abandon ship.
- Require only one kind of emergency/survival drill to be conducted each week. Thus, one week might be a fire drill, the next week a flooding drill, and the next an abandon ship drill. This change in requirements would allow more time to be devoted to each individual drill and thereby provide greater opportunity to simulate a realistic situation, to actually break out and use emergency equipment, to conduct demonstrations, and to conduct post-drill critiques. In order to assure an adequate balance of the different kinds of drills, the requirements could specify, for example, that the weekly drills be comprised of at least one abandon ship and two fire drills per month. Such a change in the regulations would eliminate the "first-fire, second-abandon ship" syndrome and would permit an element of surprise in drills, i.e., the crew may know in advance when the drill will be held, but does not need to be told what the drill will be.
- Require one drill per quarter to be held at night. This requirement would necessitate a change in most union contracts which require drills to be held between 8 a.m. and 5 p.m. on weekdays, but because of the limited number of night drills, might be acceptable.
- Require that every other abandon ship drill consist of muster at liferaft stations and instruction in operation of liferafts. Further require that once per year, just prior to time to deliver liferafts for servicing, a liferaft be inflated on deck. As an alternate procedure, authorize ships to carry a training liferaft which can be inflated in the water and used to practice boarding and righting.
- Require that abandon ship drills include training in operation of lifeboat radios and personal survival techniques.
- Authorize viewing of approved audio-visual survival training aids as a partial substitute for drills, e.g., a film on firefighting showing use of breathing apparatus could be shown followed by an actual demonstration and use of the breathing apparatus.

The second approach to improving drills is to provide ships with assistance in planning a comprehensive survival training program and carrying out realistic emergency drills. The proposed method, as previously discussed in paragraph 6-6, would be to develop a "Shipboard Survival Training Guide" which would provide specific guidance for shipboard training programs and conduct of drills. The guide would contain a number of different scenarios covering different types of drills aboard different types of ships, e.g., tankers, dry bulk carriers, LNG's, containerships, RO-ROs, etc. Each scenario would specify the objectives of the drill, the emergency situation, the location, the emergency gear to be used, the personnel to be involved, procedures for simulating the emergency, points to be observed in conduct of drill by trainees, and suggestions for adding realism such as smoke pots, plastic wounds, blacked-out compartments, etc. The guide would also contain outlines and suggestions for conducting instruction in the operation of emergency gear, such as breathing apparatus and portable fire extinguishers, and survival techniques. It is envisioned that the guide would be distributed to all ships through shipping companies. Training activities would also receive copies. Preparation of the guide would be supervised by representatives of the Coast Guard, the Maritime Administration, shipping companies, unions, and maritime training activities.

#### 6-9 COAST GUARD INSPECTIONS OF SHIPBOARD SURVIVAL DRILLS

Fire and boat drills conducted by ships' crews on the occasion of Coast Guard annual and biennial inspections largely duplicate the routine weekly drills carried out at sea. As another approach to improving shipboard training,

it is suggested that the Coast Guard review its criteria for judging satisfactory performance of drills with a view to establishing and enforcing more stringent standards including a requirement to simulate emergencies. Assuming the suggestion to develop a "Shipboard Survival Training Guide" is adopted, the guide could also contain standards to be used by Coast Guard officers to judge drill performance.

Two operators in interviews stated that they would be in favor of more frequent and even unannounced Coast Guard drill inspections. Because of the shortage of Coast Guard inspectors and the additional expense, implementation of additional inspections may be impractical, but such comments would seem to indicate that more rigorous drill inspections would be accepted by operators.

#### 6-10 SAFETY MEETINGS

A recommendation advanced by one interviewee to make monthly safety meetings a Coast Guard regulatory requirement was considered and rejected. It was considered that such a regulation would be very difficult if not impossible to enforce. Instead, it is suggested that the proposed "Shipboard Survival Training Guide" contain suggestions for conducting safety meetings and for survival topics to be discussed at the meetings.

#### 6-11 OPERATOR-PROVIDED SHORE TRAINING

Very few operators provide shore survival training for their seagoing personnel. Those that do are primarily tanker operators who send their personnel to shore firefighting schools. Some drilling operators provide first aid training to their safety officials and lifeboatman training (at private schools) to rig personnel. The latter training is provided in order to meet Coast Guard requirements for certificated lifeboatmen on drill rigs. In view

of the rapid personnel turnover in most segments of the industry it is difficult to imagine that any measure short of outright regulation would result in greater use of operator-provided shore survival training. A requirement for operators to provide training to personnel who may never serve aboard their ships again would undoubtedly not be acceptable to the industry.

#### 6-12 TRAINING MATERIALS

There are few survival training materials suitable for shipboard use and those that are available are not aimed at the average seaman's reading level or designed to capture his interest. In addition, some of the available training manuals and training films are out of date and do not describe the latest survival equipment or procedures.

A few shipping and drilling operators provide excellent training materials in the form of safety bulletins, indoctrination pamphlets, and films. Some manufacturers of survival equipment also have training films available for their equipment.

There are no U.S. regulatory requirements for shipboard training materials. The revised draft of Chapter III of SOLAS contains a proposed regulation (D VII/1) which would require that a training manual on the operation and use of survival equipment be provided in each crew messroom and recreation room or in each crew cabin.

Several approaches are recommended for improvement in the availability and quality of survival training materials for shipboard use. The first approach is through the medium of regulatory requirements. The feasibility, cost, and benefits of requiring certain minimum survival training materials on

board ship should be considered. The most likely candidates for mandatory training materials are the training manuals described in the proposed SOLAS regulation and indoctrination pamphlets for new crewmembers and temporary personnel aboard drill rigs.

The proposed training manuals, if they are to be really useful, should be written to cover the specific survival equipment aboard the particular ship or class of ships. For new ships, the provision of a training manual could be a requirement of the building specifications. For existing ships, operators would have to develop and produce manuals for each class. To reduce the expense to individual operators it might be feasible for the Coast Guard to develop and provide a model manual which could be adapted to individual ships' survival equipment installations. An important requirement for the manuals would be that they be written at the average seaman's reading level and make extensive use of illustrations to retain interest.

The rapid turnover of personnel aboard most ships and the large number of transient personnel aboard drill rigs demands that some simple means be provided to quickly familiarize new personnel with the availability and location of survival equipment. A possible regulatory requirement would be for a small survival indoctrination pamphlet, brochure, or card which would contain a diagram of the ship showing the location of lifeboats, liferafts, survival capsule, escape routes, emergency gear lockers, and fire stations and equipment. The pamphlet would also explain alarm signals and provide any special instructions on survival procedures.

Existing Coast Guard training materials, particularly the "Manual for Lifeboatmen" and "Fire Fighting for Tank Vessels" should be updated and rewritten to reflect the latest survival equipment and procedures and to match the reading level of the average seaman.

It is suggested that the Maritime Administration or the Maritime Advisory Training Board establish standards for shipboard survival training materials which will assure that materials produced in the future meet the needs and aptitudes of seagoing personnel. Until new training materials are produced, it is proposed that a review of currently available materials be conducted and that the Coast Guard publish in the Proceedings a list of manuals, pamphlets, and films which it considers suitable for shipboard training together with information on how they can be obtained.

Many ships now have motion picture or television equipment for entertainment purposes which could be used to display training films. However, with few exceptions, ships do not use this capability for training. Part of the reason is the limited availability of up-to-date survival training films and part is the expense of producing or even purchasing such films. It is suggested that the Coast Guard encourage acceleration of the current Maritime Administration and Maritime Advisory Training Board program to develop training films on shipboard firefighting and survival procedures. A survey of shipping companies should be conducted to determine the population of shipboard tape-playing television receivers and the willingness of the companies to financially support the production of training film cassettes.

Finally, through its public awareness program and articles in the Proceedings and industry periodicals, the Coast Guard should foster and encourage programs to increase awareness of survival hazards, and to make maximum use of company safety programs, equipment - manufacturer training, safety bulletins, and training films. As part of this effort, the Coast Guard should give consideration to publishing a companion periodical to Proceedings aimed at the unlicensed personnel level.

#### 6-13 FIREFIGHTING TRAINING

Shipboard firefighting team training could be more realistic and more effective if all shipboard personnel receive shore firefighting training.

In the interviews there was unanimous support of shore firefighting training with many individuals advocating mandatory training for all shipboard personnel.

The only requirement for firefighting training in U.S. regulations is the proposed rule requiring such training for tankermen. The IMCO convention on Standards of Training, Certification, and Watchkeeping require that deck and engine licensed personnel and ratings have firefighting training.

It is proposed that the Coast Guard review its licensing and certification requirements with a view to requiring shore firefighting training for all licensed and certificated personnel.

In addition to initial training, consideration should be given to requiring periodic refresher training, for example, every five years.

#### 6-14 EMERGENCY SITUATION DECISION MAKING AND LEADERSHIP TRAINING

Marine casualty reports support the opinions expressed in interviews by a number of shipping operators, safety directors, instructors, and Coast Guard officers that many masters and licensed officers are deficient in the ability to make correct decisions and exercise effective leadership in emergency situations. There are no regulatory requirements for training in this area nor are there any courses available. The following approaches to improving emergency situation decision making and leadership abilities are suggested:

- Request the Maritime Administration develop a "Survival Operations Manual" for distribution to all merchant ships. This manual would contain guidance for emergency situation decision making and

emergency squad and lifeboat/liferaft leadership. Contents might include case histories of marine casualties in which command decisions or leadership played an important part as well as emergency situation and survival-at-sea decision making and leadership problems.

- In conjunction with Coast Guard annual and biennial inspections of emergency drills, include the master and other key officers in the drills and present them with simulated emergency situations which require analysis of information and critical decisions.
- Increase emphasis on emergency situation decision making problems in licensing, particularly master's, examinations.
- Propose that maritime academies develop special short courses for prospective masters which would include training in emergency situation decision making. Such courses might be made mandatory prior to assuming command.
- Increase awareness of problem by publishing articles in the Proceedings and industry journals.

#### 6-15 EDUCATIONAL AND PSYCHOLOGICAL ASPECTS

Approaches to problems created by average reading levels and language difficulties of seamen have been previously suggested. These include rewriting training materials to match seamen's reading levels, maximum use of illustrations in place of text, and design of materials to attract and retain interest (but not through use of comic book or "sexist" approaches). To guide future preparation of training materials it is also proposed that standards for reading levels and methods of presentation be developed by the Maritime Administration or the Maritime Advisory Training Board.

The proposed changes in regulations governing emergency drills and the promotion of more realistic drills together with improved operating information, training manuals, and training films should assist in overcoming some of the



current attitudes of complacency and resignation towards survival training. The proposed "Shipboard Survival Training Guide" should further assist by providing shipboard instructors with guidance and suggestions for conducting more realistic and effective training.

## SECTION 7

### CONCLUSIONS

#### 7-1 INTRODUCTION

This section presents the conclusions reached concerning survival knowledge, performance and training; survival equipment operating information, maintenance information and maintenance performance; and related regulatory requirements.

#### 7-2 PROBLEM DEFINITION

Marine casualty reports and interviews of shipboard personnel indicate the following major problems in survival knowledge, procedures, and training and equipment operating instructions and maintenance:

- Lack of effective organization and assignment of duties for emergencies aboard drill rigs.
- Inability at the command level to properly evaluate information in emergency situations and take appropriate action.
- Lack of leadership at ship, lifeboat, and emergency squad command levels.
- Failure to conduct emergency drills and carry out shipboard survival training as required by regulations.
- Inadequate knowledge of the operation of survival equipment and survival procedures, such as launching and operation of lifeboats; use of liferafts; meaning of alarms; wearing of personal flotation devices; water entry from a height; operation of portable lifeboat radios; helicopter rescue procedures; firefighting techniques; operation of fixed CO<sub>2</sub> systems; and minimizing effects of hypothermia.
- Inadequate or unavailable operating instructions for survival equipment such as portable radios and survival capsules.

- Unsatisfactory operating or material conditions of survival equipment as a result of failure to carry out required inspections and maintenance.

### 7-3 OPERATING INSTRUCTIONS AND INFORMATION

- Based on the limited sample observed, posted operating instructions and information are deficient in the following respects.
  - Unavailable for certain equipment such as lifeboat launching equipment and lifeboat engines and for survival procedures such as the proper way to put on a life preserver, jump into the water, and minimize hypothermia
  - Not always located where they will be immediately available to persons operating the equipment
  - In some cases, difficult to read because of size of print, printing background, placement, lighting, or weathering
  - For certain equipment, wordy, difficult to understand and even incorrect
- Current specifications and regulations governing survival equipment posted operating instructions fail to provide uniform, consistent requirements which would ensure easily readable and readily understandable operating instructions and information for all survival equipment and personal survival procedures.

### 7-4 MAINTENANCE INFORMATION AND PERFORMANCE

- The lack of any specifications or standards for survival equipment maintenance manuals contributes to such deficiencies as poorly defined maintenance requirements, illegible drawings, and lack of a schedule of periodic maintenance requirements.

- Based on the limited sample observed, few ships have a documented maintenance program for survival equipment, or have adequate information on survival equipment maintenance requirements, or keep records of maintenance performed. This situation undoubtedly contributes to the poor material and operating conditions observed.
- Marine casualty reports and ship observations indicate that survival equipment is often inadequately maintained particularly in the areas of corrosion control and lubrication of lifeboats and lifeboat launching gear.

#### 7-5 TRAINING

- The high rate of crew turnover in most ships frustrates and complicates efforts to attain an adequate level of survival training particularly with respect to developing teamwork. It also greatly reduces or eliminates operators' willingness to expend time or money in providing any additional survival training or training aids beyond that required by regulations.
- Other contributing factors to the low level of shipboard survival training are the requirement to pay overtime for training other than the weekly fire and boat drill, the high tempo of operations, a lack of interest by shore management, and the lack of any motivating factors other than U.S. Coast Guard regulations.
- Survival training on drill rigs is complicated by the lack of a well-defined chain of command for emergencies and the large number of non-seagoing, transient personnel.
- The lack of uniformity in the type and level of pre-sea survival training detracts from the ability to conduct realistic emergency drills aboard ship.

- Typical station bills do not provide adequate organization or assignments for effective action in emergencies. Deficiencies include lack of liferaft assignments; no backup emergency squads; no engineering personnel in emergency squads; no one assigned to first aid; no man overboard and rescue stations; and, on drill rigs, lack of a well-defined chain of command and assignment of specific duties.
- Current Coast Guard regulations and inspection procedures are not effective in obtaining an adequate level of shipboard survival training through drills. Typically, drills are performed by rote with minimal compliance with regulatory requirements. Emergency equipment is not used or demonstrated, and emergency situations are not simulated.
- The standard procedure of fire drill first always followed by boat drill tends to breed a conditioned response to shipboard emergencies to abandon ship rather than cope with the emergency and to always abandon via lifeboats.
- The absence of any regulatory requirement for liferaft training is reflected by an almost total lack of such training aboard ships.
- Safety engineer visits, safety meetings, and training by survival equipment manufacturers and private safety training firms are valuable adjuncts to shipboard survival training but are used by relatively few shipping companies.
- A lack of well-prepared, up-to-date, effective survival training materials such as posters, pamphlets, manuals, and films suitable for shipboard use contributes to the low level of knowledge of survival equipment procedures and operation and personal survival techniques.
- The usefulness of existing survival materials is limited by the fact that they are not written to the average seaman's reading level or designed to capture his interest.

- Safety indoctrination pamphlets or check-off lists used aboard some ships and drill rigs are an effective method of indoctrinating new personnel in the types and locations of survival equipment. These materials would help to alleviate the problems caused by rapid crew turnover coupled with major differences in survival equipment installations in different types of ships and new types of survival equipment.
- Firefighting training with actual fires at shore schools is the most effective method of instilling firefighting skill and confidence. If all crewmen received this training, emergency team training aboard ship could be far more effective.
- Operator-provided shore training such as that provided by some tanker and LNG operators is an effective supplement to shipboard training but the rapid crew turnover experienced by most shipping operators makes them unwilling to invest in this type of training.
- Marine boards of investigation have found lack of organization, leadership, and ability to correctly evaluate information and make appropriate decisions in emergencies to be principal causal factors in a number of marine casualties. In the opinion of many industry interviewees, these shortcomings are common, and indicate an urgent need for emergency situation leadership and decision-making training for merchant marine officers, particularly masters.
- Years of fire and boat drills by rote and lack of interest by shore management and ships' officers have created attitudes of indifference, complacency, and resignation to survival hazards among most seamen.
- Development of training programs and training materials for shipboard use must take into consideration educational problems created by low average reading levels of seamen (7th to 8th grade), language difficulties, and lack of trained instructors.
- Use of scare tactics and training materials with a comic book or "sexist" approach have been found not to be particularly effective.

## SECTION 8

### RECOMMENDATIONS

#### 8-1 INTRODUCTION

The objective of this study as set forth in the Statement of Work was to develop one or more recommended approaches for the Coast Guard to take in establishing requirements for on-board crew training in survival equipment and for survival equipment routine maintenance information. In addition, the study also investigated the availability and adequacy of posted operating instructions and information.

As is evident from the survey of on-board training, regulations by themselves are not effective in achieving a satisfactory state of survival training or survival equipment readiness. As a result, in developing recommendations, other measures which the Coast Guard could take or could encourage other government and industry organizations to take were also considered and are included in the recommended approaches that follow.

#### 8-2 OPERATING INSTRUCTIONS AND INFORMATION

The following are recommended approaches for improving the availability and usefulness of posted operating instructions and information:

- Review and revise specifications and regulations for all types of survival equipment and survival procedures to establish uniform, definitive requirements and standards for posted (or attached) operating instructions and information. Requirements should cover:
  - Equipment and procedures for which posted operating instructions or procedures are to be provided
  - Location and lighting including emergency lighting.
  - Format, type size, color, background, etc.
  - Style, reading level, and use of illustrations.

- Provide guidance and require Coast Guard inspectors to inspect for adequacy of posted survival equipment operating instructions and survival procedures information.
- Publish information on availability of survival equipment operating information posters in Proceedings.
- Request the Maritime Administration or other appropriate agency to develop and provide posters on such survival procedures as water entry from a height, hypothermia, helicopter rescue, and lifeboat/liferaft survival techniques.

### 8-3 MAINTENANCE INFORMATION AND PERFORMANCE

The following recommended approaches are offered to improve maintenance of survival equipment.

- Revise specifications for survival equipment to include a requirement for a maintenance manual (if maintenance is required) with contents as prescribed by the proposed SOLAS regulation D VII/2.
- Require ships to have an approved, documented maintenance program for survival equipment which would include a schedule of the maintenance requirements (regulatory and manufacturer) for each equipment and a record of their accomplishment. A precedent for such a requirement is the requirement in NVIC 1-69 for an approved maintenance program for unattended engineering plants.

### 8-4 TRAINING

The following approaches are recommended to improve training in survival procedures and operation of survival equipment:

#### a. Pre-Sea Training

- Require that every prospective seafarer be given survival training as prescribed in Resolution 19 of the IMCO Convention on Standards of Training, Certification, and Watchkeeping before going to sea.



b. Training Programs and Responsibilities

- Develop a "Shipboard Survival Training Guide" which would provide a recommended program of drills, exercises, demonstrations, etc.; suggested assignments of training responsibilities; and scenarios for drills.

c. Station Bills

- Revise station bill requirements in 46 CFR 97.13 to require more adequate organization and assignment of personnel to meet all types of emergencies including man overboard and rescue of survivors.
- Revise Coast Guard form CG 848 (Rev 6-67), Specimen of a Standard Station Bill, to show sample stations and assignments in keeping with revised requirements. Prepare sample bills for different types of ships with present-day manning scales.

d. Drills

- Eliminate the term "fire and boat drills." Use "emergency drills" or "survival drills" to cover all types of drills, i.e., fire, flooding, abandon ship, man overboard, and rescue.
- Require only one type of drill per week instead of both fire and abandon ship drills. Specify a required frequency for each type of drill, e.g., two fire drills, one abandon ship, and one other type of drill per month.
- Require one drill per quarter to be held at night.
- Require every other abandon ship drill to be a liferaft drill.

- Require abandon ship drills to include instructions in operation of lifeboat radios and personal survival techniques.
- Authorize viewing of audio-visual training aids as a partial substitute for drills (showing of film must be followed by demonstration or use of equipment to qualify as a drill).
- Include in the previously proposed "Shipboard Survival Training Guide," to be distributed to all ships, scenarios for different types of drills aboard different types of ships. Scenarios would specify objectives of drill, the emergency situation, the location, emergency gear to be used, personnel to be involved, points to be observed, procedures for simulating and adding realism. Also include instructor guides for conducting instructions and demonstrations covering various types of survival equipment and procedures.

e. Coast Guard Inspections of Drills

- Establish and enforce more stringent standards and requirements for Coast Guard inspections of drills including a requirement to simulate emergencies.

f. Safety Meetings

- Include suggestions for conducting safety meetings and for survival topics in the proposed "Shipboard Survival Training Guide."

g. Training Materials

- Consider establishing mandatory requirements for crew survival training manuals as set forth in the SOLAS proposed regulation D VII/1 and for survival indoctrination pamphlets for new crewmembers.

- Update and rewrite Coast Guard training materials, particularly "Manual for Lifeboatman" and "Fire Fighting for Tank Vessels" to reflect latest survival equipment and procedures and to match reading level of the average seaman.
- Request the Maritime Administration or Maritime Advisory Training Board to establish standards for survival training materials.
- Publish a list of available, up-to-date survival training materials and their sources in the Proceedings.
- Conduct a survey of shipping companies to determine the population of tape-playing television receivers and the willingness of the companies to financially support the production of training film cassettes.
- Encourage acceleration of the Maritime Administration and Maritime Advisory Training Board program to develop training films on shipboard firefighting and survival procedures.
- Foster and encourage programs to increase awareness of survival hazards and to make maximum use of company safety programs, equipment-manufacturer training, safety bulletins, and training films through the public awareness program and articles in the Proceedings.
- Consider publishing a companion periodical to the Proceedings, aimed at the unlicensed personnel level.

#### h. Firefighting Training

- Require shore firefighting training for all licensed and certificated personnel. Require refresher firefighting training every five years.

i. Emergency Situation Decision Making and Leadership Training

- Request the Maritime Administration develop a "Survival Operations Manual" for distribution to all merchant ships. This manual would contain guidance for emergency situation decision making and emergency squad and lifeboat/liferaft leadership.
- In conjunction with Coast Guard annual and biennial inspections of emergency drills, include the master and other key officers in the drills and present them with simulated emergency situations which require analysis of information and critical decisions.
- Increase emphasis on emergency situation decision-making problems in licensing, particularly master's, examinations.
- Propose that maritime academies develop special short courses for prospective masters which would include training in emergency situation decision making. Such courses might be made mandatory prior to assuming command.
- Increase awareness of problem by publishing articles in the Proceedings and industry journals.

APPENDIX A  
RESOLUTION 19 OF INTERNATIONAL CONVENTION OF STANDARDS  
OF TRAINING, CERTIFICATION AND WATCHKEEPING FOR  
SEAFARERS, 1978

ANNEX  
RECOMMENDATION ON TRAINING OF SEAFARERS  
IN PERSONAL SURVIVAL TECHNIQUES

Every prospective seafarer should, before being employed in a sea-going ship, receive approved training in personal survival techniques. In respect of such training the following recommendations are made:

1. Every prospective seafarer should be instructed in the following:
  - (a) types of emergencies which may occur, such as collisions, fire and foundering;
  - (b) types of life-saving appliances normally carried on ships;
  - (c) need to adhere to the principles of survival;
  - (d) value of training and drills;
  - (e) need to be ready for any emergency and to be constantly aware of:
    - (i) the information in the muster list, in particular:
      - (1) his specific duties in any emergency;
      - (2) his own survival craft station;
      - (3) the signals calling all crew to their survival craft or fire stations;
    - (ii) location of his own and spare life-jackets;
    - (iii) location of fire alarm controls;
    - (iv) means of escape;
    - (v) consequences of panic;
  - (f) actions to be taken when called to survival craft stations, including:
    - (i) putting on suitable clothing;
    - (ii) donning life-jacket;
    - (iii) collecting additional protection such as blankets, time permitting;
  - (g) actions to be taken when required to abandon ship, such as:
    - (i) how to board survival craft from ship and water;
    - (ii) how to jump into the sea from a height and reduce the risk of injury when entering the water;

- (h) actions to be taken when in the water, such as:
  - (i) how to survive in circumstances of:
    - (1) fire or oil on the water;
    - (2) cold conditions;
    - (3) shark-infested waters;
  - (ii) how to right a capsized survival craft;
- (i) actions to be taken when aboard a survival craft, such as:
  - (i) getting the survival craft quickly clear of the ship;
  - (ii) protection against cold or extreme heat;
  - (iii) using a drogue or sea anchor;
  - (iv) keeping a look-out;
  - (v) recovering and caring for survivors;
  - (vi) facilitating detection by others;
  - (vii) checking equipment available for use in the survival craft and using it correctly;
  - (viii) remaining, so far as possible, in the vicinity;
- (j) main dangers to survivors and the general principles of survival, including:
  - (i) precautions to be taken in cold climates;
  - (ii) precautions to be taken in tropical climates;
  - (iii) exposure to sun, wind, rain and sea;
  - (iv) importance of wearing suitable clothing;
  - (v) protective measures in survival craft;
  - (vi) effects of immersion in water and of hypothermia;
  - (vii) importance of preserving body fluids;
  - (viii) protection against seasickness;
  - (ix) proper use of fresh water and food;
  - (x) effects of drinking sea water;
  - (xi) means available for facilitating detection by others;
  - (xii) importance of maintaining morale.

2. Every prospective seafarer should be given practical instruction in at least the following:
  - (a) wearing a life-jacket correctly;
  - (b) entering the water from a height wearing a life-jacket;
  - (c) swimming while wearing a life-jacket;
  - (d) keeping afloat without a life-jacket;
  - (e) boarding liferafts from ship and water while wearing a life-jacket;
  - (f) assisting others to board survival craft;
  - (g) operation of survival craft equipment including basic operation of portable radio equipment;
  - (h) streaming a drogue or sea anchor.

APPENDIX B  
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Code of Federal Regulations, Title 46

Part 12 - Certification of Seamen

Parts 31 - 35 - Applicable Tank Vessel Rules

Parts 71, 75, 76, 77 and 78 - Applicable Passenger Vessel Rules

Parts 91, 95, 96 and 97 - Applicable Cargo and Miscellaneous Vessel Rules

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Department of Transportation, USCG, SS CV Seawitch - SS Esso Brussels (Belgium); Collision and Fire in New York Harbor on 2 June 1973 with loss of life. Released - 2 March 1976.

Department of Transportation, USCG, SS Edmund Fitzgerald; Sinking in Lake Superior on 10 November 1975 with loss of life. Report date - 26 July 1977.

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U. S. Coast Guard, Coast Guard/Maritime Administration Policy Statement Concerning Qualifications of Crews of United States Merchant Vessels, 6 September 1974.

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APPENDIX C  
INTERVIEW, INQUIRY, AND VISIT DATA

C-1 INTERVIEWS

The following individuals were informally interviewed to obtain information, comments, and recommendations concerning any and all aspects of survival training and maintenance of survival equipment. The majority of the interviews were conducted by telephone, however, some were conducted during personal visits and are so indicated. Personal visits also included a tour of the facilities at the Harry Lundeberg School of Seamanship, Piney Point, Maryland and the U.S. Merchant Marine Academy, Kings Point, New York.

Director Office of Maritime Safety and Standards, Occupational Safety and Health Administration, Washington, D.C.

President, Ships Operational Safety, Inc., Port Washington Harbor, N. Y.

Chairman Executive Committee, Marine Division of the National Safety Council, World Trade Center, New York, N. Y.

Director, Marine Division, National Safety Council, Chicago, Illinois

Director, The Center for Safety, New York University, New York, N. Y.

Membership Chairman, American Society of Safety Engineers, Park Ridge, Illinois

Associate Professor of Safety Education, School of Public Health, University of North Carolina, Chapel Hill, N. C.

Regional Director of Training, Norfolk Naval Station, Norfolk, Virginia

Safety Director, Energy Transportation Corporation, New York, N. Y.

Director, On-Board Safety Training, Navy Safety Center, Norfolk, Virginia

Marine Safety Advisor, Marine Transportation Dept., Mobil Oil Company, New York, N. Y.

Vice President, Operations, El Paso Marine Co., Houston, Texas

Safety Director, El Paso Marine Co., New York, N. Y.

Manager Marine Safety, Marine Transportation Dept., Mobil Oil Company, New York, N. Y.

Manager Ports and Terminals, International Fleet, Marine Transportation Dept., Mobil Oil Company, New York, N. Y.

Director, Safety Training, Gulf Trading & Transportation Co., Philadelphia, Pennsylvania

Director, Petroleum Fire Fighting, Texas A & M University, College Station, Texas

President, Snokey Fire Fighting Company, Philadelphia, Pennsylvania

Senior Safety Inspector, Chevron Shipping Company, San Francisco, California

Secretary/Treasurer, Maritime Training Advisory Board, Upgrading & Training Program, National Maritime Union, New York, N. Y. (Visit)

Director, Safety, Keystone Shipping Company, Philadelphia, Pennsylvania

District Safety and Health Manager, Fifth Coast Guard District, Norfolk, Virginia

Safety Director, Moore McCormack Lines, Inc., New York, N. Y.

President, Harry Lundeberg School of Seamanship, Seafarers International Union, Piney Point, Maryland

Director of Safety, Lykes Brothers Steamship Co., Inc., New Orleans, LA

Training Specialist, Maritime Administration, Dept of Commerce, Washington, D.C.

Safety Consultant, Delta Steamship Lines, Inc., New Orleans, Louisiana

Marine Manager and Assistant Marine Manager, Farrell Lines, Inc., San Francisco, CA

Director, Maritime Administration Regional Office, San Francisco, CA

Officer in Charge, Marine Inspection, Twelfth Coast Guard District, USCG, San Francisco, CA

Superintendent, Employee Services, Lake Shipping, U. S. Steel Corp., Duluth, Minnesota

Director of Safety and Loss Prevention, Farrell Lines, Inc., New York, N. Y. (Visit)

Director, Marine Institute of Technology and Graduate Studies, International Organization of Masters Mates and Pilots, Baltimore, Maryland

Vice President, Contracts, Seafarers International Union, New York, N. Y.

Director, Safety Training, Calhoun MEBA Engineering School, Baltimore, Maryland

Administrating Assistant, MEBA, Washington, D. C.

Senior Surveyor, Statutes Dept., American Bureau of Shipping, New York, N. Y.

Director, Safety Training, Moore-McCormack Lines, Inc., New York, N. Y.

Project Manager, MARAD Human Resources Study, Eclectech Associates, Inc., North Stonington, Connecticut

Staff Members, Harry Lundberg School of Seamanship, Seafarers International Union, Piney Point, Maryland (Visit)

Head, Dept. of Nautical Science, Assistant Head, Dept. of Nautical Science, U. S. Merchant Marine Academy, Kings Point, N. Y. (Visit)

Director of Safety, Global Marine, Inc., Houston, Texas (Visit)

Safety Director, Ocean Drilling & Exploration Company, Inc., New Orleans, Louisiana (Visit)

Port Captain, United States Lines, Inc., New York, N. Y. (Visit)

Director of Safety, Port Engineer, Delta Steamship Lines, Inc., New Orleans, Louisiana (Visit)

Offshore Liaison Officer, Marine Inspection Office, Eleventh Coast Guard District, New Orleans, Louisiana (Visit)

## C-2 MANUFACTURER INQUIRIES

Letters of inquiry were sent to thirty manufacturers of survival equipment requesting information on their products and on the nature and content of maintenance and training information and service offered to the user. The following eighteen manufacturers replied, in most cases furnishing copies of brochures or manuals on their equipment.

### Exposure Suits

Bayley Suit, Inc., 900 South Fortuna Boulevard., Fortuna, California 95540

Imperial Manufacturing Corporation, P.O. Box 4119 Airport Industrial Park, Bremerton, Washington, 98310

### Line Throwing Appliances

Naval Company, Old Easton Highway, Doylestown, Pennsylvania 18901

Kilgore Corporation, Toone, Tennessee 38381

Smith and Wesson Chemical Company, Inc., P.O. Box 208, Rockcreek, Ohio 44084

### OBA's and Gas Masks

Mine Safety Appliance Company, 201 North Braddock Avenue, Pittsburgh, Pennsylvania 15208

Globe Safety Products, Inc., 125 Sunrise Place, Dayton, Ohio 45407

### Davits and Mechanical Disengaging Apparatus

Whittaker Corporation, 5159 Baltimore Drive, Lamesa, California 92041

Carroll Engineering Company, 313 State Street Box 711, Perth Amboy, New Jersey 08862

Lakeshore, Inc., Iron Mountain, Minnesota 49801

### EPIRB

Marine Technology Division of Dayton Aircraft, Inc., P.O. Box 70, Fort Lauderdale, Florida 33302

### Life Boats

Lane Lifeboat Division of Lane Marine Technology, Inc., 150 Sullivan Street, Brooklyn, New York 11231

Marine Safety Equipment Corporation, Foot of Wyckoff Road, Farmingdale, New Jersey 07727

Watercraft America, Inc., Mr. Joda Currie, President, P.O. Box 307, Mims, Florida 32754

Whittaker Corporation, Mr. Jerry Laibson, Dir./Engr., 5159 Baltimore Drive, La Mesa, California 92041

Portable Lifeboat Radio

ITT Mackay Marine, 133 Terminal Avenue, Clark, New Jersey

Fire Detection and Alarm Systems

Detex Corporation, 53 Park Place, New York, New York 10007

Fenwal, Inc., Ashland, Massachusetts 01721

### C-3 SHIP/DRILL RIG VISITS

Five cargo ships, one drill ship, and two mobile drilling units were visited. Fire and boat drills were observed on a containership and a mobile drilling unit. Masters and Chief Mates were interviewed concerning the ship's survival training program; conduct of drills; demonstration of survival equipment; safety meetings; and survival equipment maintenance responsibilities, information, performance and records. Licensed and unlicensed personnel were interviewed informally to gain an appreciation of their knowledge and understanding of the operation of survival equipment and survival procedures. Survival equipment was examined to ascertain material and operating conditions and evidence of performance or lack of performance of maintenance. The following ships and drilling units were visited:

AUSTRAL ENDURANCE, Farrell Lines

C.V. LIGHTING, Farrell Lines

EXPORT PATRIOT, Farrell Lines

AFRICAN NEPTUNE, Farrell Lines

AMERICAN LEGACY, U.S. Lines

GLOMAR PACIFIC, Global Marine (Drill Ship)

SEMI-I, Global Marine (Mobile Drilling Unit)

OCEAN VIKING, Ocean Drilling and Exploration Co. (Mobile Drilling Unit)

OCEAN DRILLER, Ocean Drilling and Exploration Co. (Mobile Drilling Unit)





THE STANWICK CORPORATION  
OPERATING SYSTEMS GROUP

Serial CN-275  
June 19, 1980

Commandant (G-FCP-2/71)  
U. S. Coast Guard  
Washington, D. C. 20590

Subject: Contract DOT-CG-827681-A

Gentlemen:

The Whittaker Corporation, Survival Systems Division, of La Mesa, California has taken exception to certain statements and conclusions contained in the final report of the subject contract with regard to survival capsules. The purpose of this letter is to clarify the misunderstandings which have arisen.

In the report, as in the Coast Guard's Statement of Work, the term "survival capsule" is used in a general sense to refer to all types of totally-enclosed, rigidly-constructed, survival craft regardless of manufacturer. Writers of the report were, unfortunately and regrettably, unaware that within the industry, the term "survival capsule" equates to Whittaker survival craft.

The conclusions regarding operating instructions, maintenance instructions, and manufacturer training support for totally-enclosed survival craft are overall conclusions based on information and materials received from all manufacturers contacted, not just those received from Whittaker.

The statement concerning the difficulty in understanding the operating instructions in a survival capsule was based on instructions examined in a Whittaker capsule during a drill rig visit. It has been brought to our attention that these were an older set of instructions prepared approximately five years ago which have since been superseded. We have examined the current operating instructions for Whittaker survival capsules and find them to be readily understandable. In fact, they could well serve as a model for such instructions.



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Page 2

Subject: Contract DOT-CG-827681-A

The project team also considered the maintenance instructions and training support provided by Whittaker to be superior. The statement in the report that one maintenance manual provided a summary of all maintenance requirements in a single chart as opposed to scattered throughout the manual or in several manuals was, in fact, a reference to Whittaker maintenance manuals.

Sincerely,

J. W. Viele  
Project Engineer

JW/lms

copy to: Commandant (G-MMT-3/83)  
U. S. Coast Guard  
Washington, D. C. 20590

The Whittaker Corp., Survival Systems Division  
6159 Baltimore Drive  
La Mesa, Ca. 92041  
Mr. Jerry Laibson

